546-2366-85

JPRS-WST-85-020

7-12-85

5 July 1985

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West Europe Report

SCIENCE AND TECHNOLOGY

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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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NEW BRANCH FOR CERAMICS, SILICON, GALLIUM AT RHONE-POULENC

Paris L'USINE NOUVELLE in French 20-27 Dec 84 p 24

[Article by Alain Pauche and Philippe Lanone: "A High-Tech Pole at Rhone-Poulenc"]

[Text] Regroup activities without restructuring, adopt a market logic, improve cooperation in the fields of research and technology--the creation of a "division of fine inorganic chemistry" reveals the new strategy of the group.

Rhone-Poulenc is continuing the reorganization of its chemicals branch, which represents one-third of its revenue (43 billion). The Number 1 of French chemistry has just created a new division, baptized the division of fine inorganic chemistry. It combines all the activities of fine inorganic chemistry. A decision which, although unspectacular, since no industrial restructuring is anticipated, is nevertheless revealing as to the new strategy of Rhone-Poulenc.

This division, placed under the management of Jean-Pierre Seeuws, covers the sectors of the rare earths, of which Rhone-Poulenc is the world leader, of gallium, aluminas and catalysts, silica pigments, titanium oxides and derivatives, and the activities of the Potash and Chemical Products Company, and their brominated derivatives. The new division is also responsible for the development of ceramics, polycrystalline silicon, and glass compounds.

In creating this fine inorganic chemistry group, which today has a revenue of 2.5 billion francs, Serge Tchuruk, general manager of Rhone-Poulenc, indicates the route that he intends to follow: combine the activities without restructuring them, adopt a market logic, and improve cooperation in the fields of research and technology.

The coincidence of the creation of this new division with the reduction in size of the management team of Rhone-Poulenc magnifies its scope. After the departure of Jean-Marc Bruel, General Manager, several weeks ago, Serge Tchuruk became the Number 2 of the group. The general management henceforth is led by Loik LeFloch Prigent, President and General Manager, Serge Tchuruk, and Michel Vaquin, Associate General Manager. Jean-Pierre Halbron, Treasurer, and Gustave Strain, Director of Research, complete a staff reduced to five members.

The concentration of know-how corresponds to the reduction in the size of management. "Our know-how up to now has been too dispersed and insufficiently oriented toward a market logic," Serge Tchuruk stated to L'USINE NOUVELLE. From this came the idea of combining the various activities according to the similarity of their markets, and the possibility of making use of the complementary technologies as well as research cooperation.

"The products of this division are addressed to strongly developing markets," continues Serge Tchuruk. He adds: "They are those of the future: electronics, catalysis with the enormous potential market of catalytic exhausts and the markets for certain inorganic materials, such as ceramics, which are likely to explode!"

From the technological point of view, the interchanges will be numerous. The alumina activity, detached from the division of chemical specialties, has a large amount of know-how in the field of catalysis with the subsidiary Procatalyse, which already supplies American manufacturers such as General Motors or Ford.

The oxides of titanium, developed particularly by Thann and Mulhouse, subsidiary of Rhone-Poulenc, which are traditionally oriented toward the paint and varnish market, will find applications in the field of catalysis and ceramics. It will be possible to substitute gallium for silicon in certain applications. Finally, certain catalysts are activated by separated rare earths, a field in which Rhone-Poulenc is the world leader.

However, the advantage of such an association is found especially upstream, in the field of research. "The synergies will be fantastic!", predicts Serge Tchuruk. All these specialties actually arise from the same scientific attainment: the knowledge of inorganic substances and their purification. The research services of the new division will be combined in the group's Aubervilliers laboratories. "We will turn to the markets of the future, explains Serge Tchuruk. This reorganization shows our determination to be present in these markets."

Characteristic Common to All of These Markets: A Worldwide Dimension

Among other future projects: the creation of an ultrapure silicon facility to supply the factory of the group's common subsidiary and of the American company Siltec, which produces silicon wafers for the electronics industry. On the other hand, in the field of silica pigments, a research program has been started to find substitution products for carbon black.

A common characteristic of these markets is their worldwide dimension. This produces a research policy involving foreign partnership, either by purchase of companies or by creation in association with other companies. In the field of polymers, for example, a sector undergoing very strong expansion (close to 10 percent annually for the silicones), two subsidiaries have been purchased in Germany, and "joint ventures" have just been concluded in Japan.

An international dimension, pursuit of the market niches of chemistry corresponding to downstream sectors, development of research (2.4 billion in 1983), the current reorganization conforms well to the new strategy of Rhone-Poulenc. A profitable strategy, judging from the good results of the group in 1984 (800 million in profits in the first half year).

For Serge Tchuruk, the good world economic picture does not explain the performance for this year. "The restructuring operations which have been going on for 3 or 4 years in basic chemistry are beginning to bear fruit. We have dropped primary processing products, and we have closed facilities that are obsolete or of inadequate size. Today, our chemistry branch is as productive as its worldwide competitors."

An optimist for the results of the group in 1984 and 1985, Serge Tchuruk fears that the reversal of the economic picture expected in this year of 1985 will produce disturbances in 1986. All the more reason to reorganize Rhone-Poulenc and to orient it to the new markets.

The Components of the New Division

Sectors	Strongly developing markets involved	Sites
Rare earths Gallium	Catalysis, electronics, ceramics	La Rochelle (Charente-Maritime)
Aluminas	Catalysis, ceramic packing	Salindres (Gard)
Silica pigments	Catalysis, absorption packing, electronics	Collonges-au-Mond-d'Or (Rhone)
Titanium oxides and derivatives	Catalysis packing	Thann (Haut-Rhin) Le Havre (Seine-Marit.)
Ceramics	Ceramics	Activity under development
Polycrystalline silicon	Electronics	

Sources: L'USINE NOUVELLE

The activities combined in the new fine inorganic chemistry division involve strongly developing markets (catalysis, electronics, ceramics). Other than the sectors mentioned in the table, it will include the activities of the Potash and Chemical Products Company.

Caption: Four years after joining Rhone-Poulenc, Serge Tchuruk, 47 years old, X-Armement, General Manager since December 1983, becomes the Number 2 of the group. The head of the chemistry branch of Rhone-Poulenc, equally responsible for activities in the United States, favors the reorganization without upheaval. Before joining Rhone-Poulenc, his entire career was at Mobil Oil.

12902
CSO: 3698/342

BRIEFS

ASEA POWDER METALLURGY FACTORY--Asea has decided to build a new plant specializing in powder metallurgy. It will have the world's largest hot isostatic press. Operations to start in 1987; cost, 100 million Swedish kronor. [Text] [Paris INDUSTRIES & TECHNIQUES in French 1 Mar 85 p 8] 11,023

CSO: 3698/456

TWO FRENCH FIRMS FORM BIO EUROPE FOR ENZYME RESEARCH

Paris L'USINE NOUVELLE in French 7 Mar 85 p 29

[Article by Herve Plagnol]

[Text] Roussel strengthens its position in agriculture, and Sucre Union diversifies: the two firms create Bio Europe to work on enzymes.

There is still room in France for venture capital aimed at biotechnology. That is what Roussel-Uclaf, one of the three major French pharmaceutical firms (revenues of 9.1 billion francs in 1983), and Sucre Union (which controls 30 percent of the French sugar production), demonstrated by creating Bio Europe, a biotechnology research and development company. Bio Europe's goal is to "work on biocatalysis, and on purification and extraction techniques" (meaning in fact, on enzymes and fermentation), states its CEO, Jean-Bernard Borfiga, formerly of Corning Glass (he left the American glass manufacturer when the latter dropped biotechnology to concentrate its efforts on optical fibers).

For most of its shareholders, which also include four banks (Indo-Suez, Banexi, Credit Agricole, and Citibank), this company is a novelty. Roussel had not yet invested in this type of business in Europe; it preferred instead contracts with companies in which it had no invested capital. Roussel is also more widely involved in agricultural activities.

The Bio Europe investment is "to gain a better knowledge of plant treatment possibilities, to protect them, regenerate them, and obtain greater yield and quality," says the pharmaceuticals manufacturer, who already holds a strong position on the insecticide market with its agro-veterinary division (2.4 billion francs in revenues in 1983). Its leading product, the insecticide Decis, is successfully distributed throughout the world, and Roussel could take advantage of this network to sell an entirely new treatment obtained through biotechnology. The pharmaceutical company is thus interested in a position on markets which are closely or remotely associated with agriculture.

Diversification is probably also the motive force behind Sucre Union. A whole range of new products can be fabricated with enzymes, starting from agricultural raw materials. The drop in sugar prices and the introduction of competitive sugars obviously force manufacturers to seek elsewhere for the exploitation of their sugar beets. Bio Europe will thus have a role to play in this diversification, even if it is a long range one. "We will leave the researchers alone," says Regis de Baynast, director of Sucre Research and Development, a subsidiary of Sucre Union. "What matters is their performance on original projects. Otherwise all that is left is to scrape up behind the others, and that is very unpleasant: they leave very little!"

The ten or so researchers at Bio Europe (there will be others) appear very well situated for originality. Except for the technical universities at Compiegne and Toulouse, few laboratories still work on enzymes in France. Moreover, this new team will go far in development, since the business end is already recruited. And not to be overlooked is the capital investment of one of the largest American banks, Citibank, which could open many doors across the Atlantic.

Is there room for a French company on the enzyme market? "In any case, there will be room for Bio Europe," says Sucre Union.

11,023
CSO: 3698/456

BIOTECHNOLOGY

BELGIAN PGS SEEKING AGRICULTURAL MARKET

Brussels INDUSTRIE MAGAZINE in French Jun 85 pp 70-72, 75

[Article by Pierre Heymans: "PGS Wants to be a Big Hit"]

[Excerpts] Brussels -- At the beginning of 1985 researchers at Plant Genetic System [PGS] developed a plant that builds its own defenses against insects. The techniqueof DNA manipulation is not new, but the application is and it opens up immense perspectives in the agricultural field.

[Box] Founded in February 1982, PGS is a Belgian engineering firm working with agricultural and food industries. Its starting capital amounted to 400 million Belgian francs in March 1983. This capital was provided by:
- Hilleshoeg AB, a Cardo AB subsidiary, established in Sweden and the top-ranking European firm in the development of new crops. Its main activity is the development of the sugar beet and the production of beet sowing seed. It gained worldwide reputation in this field and also dominates the commerce of sowing seed for cereals, colza, corn and forestry.
- The Tirlemont refinery, a European leader in the production of sugar beets and sugar.
- Radar NV, a Belgian firm producing animal feed and its additives.
- The GIMV, the regional Flemish investment council.

In December 1982, PGS signed an agreement with Advanced Genetic Sciences Inc of Greenwich (Connecticut). Henceforth, PGS and Advanced Genetic Sciences will work together in the Scientific Board [SB]. The SB, founded by Advanced Genetic Sciences Inc in 1979, groups some of the world's best specialists in molecular biology and the chemistry of plants and bacteria. As a compensation for SB's services, Advanced Genetic Sciences Inc has received founding shares [parts de fondateur] of PGS and is represented on its board of directors and in its management.

The administrative headquarters of PGS is in Brussels (4 av. des Arts, 1040 Brussels. Telephone: (02)513-6753); and the laboratories are in Ghent (J. Plateaustraat 22, 9000 Ghent. Telephone: (091)242-525). At this moment the laboratories cover 830 m^2, but they will soon be extended to 2,500 m^2, and they will accommodate 90 to 100 researchers and technicians. The new laboratories will be located on the grounds of the Ghent university campus

and will be operational at the end of 1986. PGS also owns a laboratory of 160 m² at the ULB (Free University of Brussels).

On 1 January 1985, PGS employed 50 people: 4 in administration, 3 in the technical staff, 38 in research (14 doctors of science, 15 researchers and students, and 9 technicians) and 5 in Brussels at the protein engineering laboratory. At present, the protein engineering lab is engaged in research with the help of Solvay and financed by IRSIA (Institute for Scientific Research in Industry and Agriculture). The personnel will increase to 60 in 1985.

The Scientific Board

The SB is an international institution playing a predominant role in the management of PGS. It is composed of "superscientists" from different disciplines, the top people in each field. The SB lays down the scientific orientation of research activities. It screens the scientific contents of all Advanced Genetic Sciences Inc and PGS projects and decides whether to carry them out. Moreover, through the SB, the companies have established privileged relationships with universities and research institutes. The individual renown of each SB member is such that any laboratory or research center in the world would naturally be interested in a joint project with the SB, or with an affiliate such as PGS.

Officially the SB meets four times a year, but unofficial contacts are very frequent. Moreover, PGS has an SB member, Professor Van Montagu, permanently at its disposal. The result is quick decision making when the necessity arises.

Professor Marc Van Montagu's team, responsible for this achievement, [the development of a plant producing its own insecticide], works for the R & D section of Plant Genetic Systems.

The auto-insecticide plant is a variety of tobacco developed from a cell that received a bacillus thurigiensis plasmid. This bacteria produces endotoxins that act as insecticides which are particularly effective against caterpillars. The plasmid of this bacillus; i.e., its genetic material (DNA), is thus multiplied in all cells of the plant and directs the endotoxin synthesis. Without any apparent influence on their growth, the plants are chemically protected against caterpillar bites. The choice of tobacco in this experiment is not accidental. The plant is relatively easy to manipulate and its genetic material is well known. However, what is valid for tobacco today could well be true for cotton, beets or potatoes tomorrow.

Future Applications

Even when technical problems have been overcome, it will still take years before tobacco seed with insecticide characteristics appears on the market.

Joseph Bouckaert (chief executive officer) and Marc Zabeau (laboratory director) estimate that it will take 7 to 10 years to market the product. This time will be used by Plant Genetic Systems SA (PGS) to implement the fruits of its research. Sufficient improvements will have to be made in the product to insure its profitability and competitiveness. The road followed by PGS can be divided into various steps that are valid for any finished product.

The first step is to prove that the technique is mastered. This step has already been achieved with the tobacco plant. The second step will be a wide market analysis to discover all potentially commercial crops for the application of this technique. Then the product can be developed seriously. However, more practical criteria will have to be studied before mass production can begin. Indeed, the introduction of new genes into a food plant, for example, should certainly not alter its taste, slow down growth, nor modify the sugar contents or the yield. Only if all these requirements have been met, can commercialization begin.

At present, PGS has only worked on the implantation of bacillus thurigiensis genes to provide the insecticide defense. Initially, research is being done to widen the action range of the bacillus endotoxins and afterwards [research will be done] in other fields (virology, protein engineering and above all manipulation and implantation of bacteria to protect the roots of the plant against diseases mainly caused by fungi). No opportunities are disregarded. Hence, PGS has signed an important contract with the Brazilian government (through Embrapa, an agricultural research company, co-owned by PGS and established in Brazil). As a first step, this two-year contract envisions the isolation of the gene responsible for the synthesis of a protein rich in amino acids, based on sulphur (such as methionine) that can be found abundantly in the Brazil nut.

This protein has a high nutrition value. The second step will then be the implantation, by genetic manipulation, of the gene in industrial food crops. The first part of the project will cost roughly $1.5 million and half of it will be financed by the World Bank. PGS will also train three Brazilian geneticists in the genetic manipulation of plants. If this project succeeds, PGS will earn significant royalties. All future contracts will be cast in the same mold. PGS will not only sell its know-how, but it will participate in the profits of the finished product as well. [This is true for] both tobacco or cotton seeds (a market especially coveted by PGS) that are protected against insect attacks, and for food plant seeds that provide an enormously enhanced nutritional value.

Controlling Growth

Plant Genetic Systems Inc has other contracts beyond the one signed with Brazil. Although 7 to 8 years are necessary to commercialize a finished product, PGS contracts (in both Belgium and abroad) will span only 2 to 4 years maximum. These projects are always submitted for the SB's approval,

although it does not have an absolute veto power. Hence, if a contract appears to be very promising for PGS but is judged scientifically inopportune by the Scientific Board, then, according to Joseph Bouckaert, PGS might put the advice aside. So far this situation has never occurred and it seems highly improbable. (PGS really needs the SB's support, because it is in fact the prime source of new "brains" -- an item of incalculable value).

The close cooperation between PGS and the universities and research institutes allows them to actually transfer new technologies to fields of practical application (the classic role of an R & D company) and to make long-awaited improvements. Consequently, the outlook seems very bright for PGS. There are many applications (the best researchers all want in...the 10 new researchers for 1985 have not yet been selected). Its recent publicity has come at exactly the right moment. Is this a mere coincidence, just before the Flanders Technology Exhibition? Consequently, PGS has ambitious plans to develop its infrastructure, to train foreign technicians (as in the Brazilian contracts) and to conquer new markets. But problems may be lying ahead With relatively short-term contracts, training of foreign technicians, etc. can PGS succeed in maintaining its technological advance and in making a profit? To safeguard its advance, PGS relies on the absence of adequate infrastructure in most of the countries concerned, and on the time needed to acquire and control this knowledge , but most of all PGS counts on recruiting all the future "geniuses" of modern biotechnology that it needs. However, at this level as well, it is easier to make an advance than to keep it. The PGS example will certainly excite a lot of interest...

With regard to commercialization, PGS will have to penetrate a market controlled by a few big enterprises (producing seeds or phytopharmaceutical products). The beginning will be very difficult; especially because there are so many laboratories studying biotechnology. Thus, as we understand it, PGS is seeking to cooperate with the "leaders" and has no intention of automatically taking on a competitor's role.

The train is moving, the point is not to miss it...

25012
CSO: 3698/1017

BRIEFS

SWEDISH BIOTECHNOLOGY CENTER EXPANDING--The Karolinska Institute in Stockholm is now going to expand its research in biotechnology and advanced biology. With 35.5 million kronor available for this purpose, new work will be undertaken in connection with the celebration of the Institute's 175th anniversary. The most immediate project will be the establishment of a center for molecular biology. Astra [largest medicinals firm in the Nordic countries] and the Wallenberg Foundation have each granted 13.5 million kronor for construction of the building, which is to be ready for occupancy in 1987. Construction of a center for biotechnology is proceeding at Huddinge Hospital. The funds are being supplied by the Stockholm County government. There are plans to build a microbiology center at the beginning of the 1990's. [Stockholm DAGENS NYHETER in Swedish 1 Jun 85 p 33]

CSO: 3698/471

CIVIL AVIATION

MBB DEMONSTRATES NEW RESEARCH AIRCRAFT 'ATTAS'

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 25 May 85 p 8

[Text] Bremen, 24 May--German aviation and astronautics research will have available to it in the near future a new research and test aircraft. On Friday, this plane was demonstrated to the interested public both on the ground and in the air at its Bremen "birthplace" by the German aviation and astronautics concern of Messerschmitt-Boelkow-Blohm (MBB)--or more precisely, by its transport and passenger aircraft division. In the opinion of experts, what is surprising about this plane is that a type of aircraft has been "brought back to life" which had virtually already been consigned to the scrapheap. Another remarkable thing, it is being said, is that this plane won out in a 2-year competition over an American airplane ("Gulfstream II"), which is being used by NASA as a training airplane for Space Shuttle astronauts.

The new German research aircraft is called "Attas" (Advanced Technologies Testing Aircraft System), will be flying for the German Research and Development Institute for Air and Space Travel (DFVLR), and was developed from the VFW 614, the first modern production of a jet passenger aircraft by the FRG. The architects of this small, high-performance plane were recently recalling with a certain nostalgia that its series production had to be discontinued at the end of 1977. Only the Federal Air Force is still flying three VFW 614's at present. All the other planes which had flown in civilian service were withdrawn by the Bremen manufacturer after the then Federal Government had irrevocably announced the "end."

But one VFW 614 is now being allowed to survive--the plane with the serial number 17, which had completed its maiden flight in 1978 but then was mothballed. Finally, a contract for the conversion of the plane into a research aircraft was signed in 1981. Two other airplanes of this type were made available as assembly and function-simulating mockups on the ground.

For purposes of converting the VFW 614 into the research airplane "Attas," the plane was "stripped" of those accessories which a test airplane no longer needs, and it was modified at those points where the installation of new systems is planned. Thus, the entire cabin furnishings were removed, the control system for elevators and rudders, landing flaps, and power units was dismantled, the cockpit was completely cleared of its

instruments, and the wiring was largely removed. What remained was the main aircraft structure, which in the following period was newly outfitted--for example by a double electrohydraulic control system, a flap system for more rapidly acting on the wing lift, and a dividing of the two-man cockpit into an operating station for the test pilot and another one for the safety pilot. Also being installed in the cockpit are test instruments which are needed for research programs.

These programs are being supervised, monitored, and evaluated by four test engineers. In the airplane cabin they have at their disposal electronic work stations provided with many instruments. A central element of the testing system is a data processing facility constructed from five modern computers in the back cabin space that was originally intended for 40 to 44 passengers. This EDP system is being installed in Braunschweig into the airplane which is to begin its research service in the spring of 1986.

An important feature of the "Attas" is that this research airplane can be given the flight characteristics of other aircraft--for example, those still in the planning stage--and in this way such airplanes can be studied in advance of their development (in-flight simulation). MBB is further stating that with the "Attas" project this German aviation and astronautics concern would be able to gain important practical knowledge which may have an influence on the development of new passenger airplanes. It is stressed moreover that with the "Attas" test vehicle the German airframe and aircraft outfitting industry as well is being given an important means for the development, testing, and demonstrating of new systems approaches. With that, it is said, its competitive situation in the international arena will also be improved.

12114
CSO: 3698/466

ROBOT, LASER TRIDIMENSIONAL CUTTING TECHNOLOGY DETAILED

Turin ATA-INGEGNERIA AUTOMOBILISTICA in Italian Dec 84 pp 815-822

[Article by Elvio Berardi, Laser Robotics Division of PRIMA Progetti S.p.A.]

[Excerpt] 1. Introduction

For some years now, our firm has been producing a robot that uses a power laser to cut deep-drawn metallic and plastic parts, in other words, a machine that is capable of moving the laser beam and following a spatial trajectory no matter how complex.

This robot was initially developed to resolve the problem of tridimensional trimming of large parts made of thin plastics, lined with moquette, for the interior appointments of automobiles.

3. The ZAC System

3.1. The Robot

ZAC is a numerically controlled 5-axis robot.

The purpose of the robot is to permit the focused laser beam to follow any trajectory whatever, no matter how complex, in large-volume work, with the most appropriate angular positioning. As a result of its five coordinated movements, the laser beam is at all times orthogonal to the piece throughout the cutting trajectory.

Two overlapped tables enable movement of the piece in two planar orthogonal directions (X, Y axes). The other three movements are assigned to the laser beam: A vertical column (Z axis) guides the focusing head over the piece to be trimmed. The focusing head can shift the laser beam through two rotational movements: Rotation A (360° countinuous), and rotation B (±90° with respect to the vertical) perpendicular to A.

The optical system consists of three mirrors and a focusing lens. One of the mirrors is fixed and deflects the beam in the column; the other two are integral with the head and enable the beam to reach the focusing lens.

Although the cutting of nonmetallic materials is not particularly critical as regards focusing, the cutting of sheet metal with the laser demands very fine focusing.

Unfortunately, deep-drawn sheet-metal parts often have deformations that can be detected in precisely defined zones but whose amplitude and distribution cannot be anticipated (so-called "puckering").

Good quality cutting, therefore, cannot be obtained unless the robot is endowed with a certain self-adaptiveness to the real position of the sheet metal. This adaptiveness is provided by means of a sensor, which is located on the output nozzle and interfaced with the electronic control of the robot. During the movement of the machines's axes along the trajectory, the focusing lens is automatically moved in such a way as to ensure that the focal point will follow the real profile of the piece. This mechanism can be considered a sixth axis: Its low inertia and proportionate travel give the robot the necessary adaptiveness.

The protective gas stream is injected through the conical nozzle to the cutting spot. The same gas stream is also used to cool the lens and pressurize the interior of the nozzle so as to prevent the depositing of microparticles on the lens itself.

The rest of the optical system (upper part of the lens and the three mirrors) is protected against dust by an injection of pressurized air.

The workpiece is supported on a "pallet," positioned on the upper table (generally designated the Y table). In this way the robot can be fed by an automatic load/unload system, moving the pallet inside and outside the work area.

The structure on which the laser generator is mounted also has the function of supporting the Z column. This column has a square cross-section and the laser beam passes inside it.

The travels of the X, Y and Z axes are a function of the specific application.

3.2. The Laser Generator

The laser generator rests on the same mechanical structure that supports the column and the focusing head. This architecture permits a simple and stable alignment of the laser beam with respect to the optical system external to the generator itself.

Any CO_2 laser source presently available on the market can be used to equip the ZAC system.

Nevertheless, the following requirements must be taken into account:

--Maximum power: 1.5 kW;

--Maximum diameter of beam: 25 mm;--Maximum divergence of beam: 2 millirads;

--Provision for external "input" for analog control of power;

--Provision for external controls of laser cavity's mechanical and electronic shutters;

--Provision for external "output" for state of the shutters and troubleshooting.

In addition, the beam's energy distribution is of particular importance and must necessarily approximate the fundamental TEM_{00} mode: This is an essential requirement to obtain high-quality cutting.

3.3. The Load/Unload System

For safety reasons, the entire volume of the work is enclosed within a protective cabin into which the operator does not enter during the cutting operation.

The piece is secured and positioned on the pallet, which, at the operator's command, is automatically introduced into the work area via a mobile bulkhead. This bulkhead is electronically controlled.

To minimize the time required to unload the cut piece and load another piece, two load/unload stations are generally used.

During the cutting operation on one pallet, the operator changes the piece on the other pallet. When the cycle is completed, the robot automatically exchanges the two pallets.

Diverse pieces are generally placed on the pallets. The robot automatically recognizes the pallet and calls up from memory the related program. The entire load/unload operation--which consists of the movement of the transfer system, movement, the opening and closing of the mobile bulkhead, and control of the laser shutter and of related safeguards--is controlled by a PLC [expansion unknown] structure that is integrated into the electronics bay.

3.4. The Electronics

The robot is controlled by a universal control unit, designated "Roboprima," conceived and designed by our company especially for industrial robots.

The control unit performs the required linear and circular interpolation, integrating the programmed speed between points of the trajectory.

Each axis of the robot is managed by a smart circuit-board, while the programs, human-machine communications, androbot movements (in absolute coordinates) are managed by a control CPU [central processing unit].

In the sheet-metal cutting version, the axial movement of the lens and the nozzle is controlled as a sixth axis. The beam output power is also manipulated by the control unit via a smart circuit-board, as a seventh axis, thus enabling the maintaining of a constant relationship between speed and focused power on the piece.

3.5. Programming of the Robot

The simplest way of programming the robot is by self-learning. When a new program is needed, a sample piece, on which the cutting trajectory has been marked out, is loaded on to the robot. With the power laser turned off, the operator enters the work area and moves the robot's axes, to maneuver the focusing head's nozzle along the trajectory and memorize the points. The programmer uses a portable push-button panel to move each axis and insert all the instructions necessary to the programming.

Operating in an interactive mode, the control unit guides the operator in the startup of auxiliary functions at the right time, requests the necessary type of interpolation, etc.

During this phase, the machine can be moved in any manner desired by the operator: Along absolute axes, within axes of the tool (the laser's oriented nozzle), or rotating the A and B axes of the head about the focusing spot. The speed of the machine is automatically reduced to a maximum of 2 meters/ minute for safety reasons. The spot on which the power laser will be focused is disclosed by an He-Ne laser beam aligned coaxially with the power beam.

The phase of the programming on the piece being examined and the technological data pertaining to the material to be cut (for example, the maximum permissible speed, some local variations of the established power/speed relationship, etc) can be added to the program by means of a portable programming unit.

The programming method described is normally used, because it is simple, intuitive, easy to use, and moreover permits the ZAC system to be used as a stand-alone, independently of the environment in which it is located.

The ZAC system can also be used as a peripheral "output" in a CAD/CAM system, in which case it performs its work automatically, following the cutting trajectory that is calculated and sent to it by a remote computer.

4. Its Fields of Use

As regards the cutting of nonmetallic materials, let us consider now some typical applications.

a) **Carpeted floor coverings for automobiles:** These are generally flexible preformed pieces with plastic, rubber or felt substrate. In addition

to cutting the outside perimeter, holes of various shapes must be cut for the seat mountings, pedals, seat-belt mountings, etc.

b) **Roof covering:** Large-sized pieces of the most diverse materials, generally multilayered, sometimes foamed, always semirigid, requiring trimming of the outside perimeter, and holes for attachment to the roof and for other purposes. The flexibility of the ZAC system is especially appreciated when some pieces within a production run must be customized (sun roof).

c) **Baggage compartment lining:** Moderate-sized pieces but very deep-drawn. Generally, moquette cemented to a semirigid substrate (ABS, PVC), very difficult to cut using traditional techniques, and requiring the cutting of outside perimeter and openings of various types.

d) **Door-lining panels:** Rigid material lined with artificial leather or moquette.

e) **Dashboards:** Often multilayered with rigid support, external leather covering and a polyurethane foam interlayer. Even though the support is injection molded, the outside perimeter of the leather must be trimmed and holes and openings of various types must be cut into the leather and the foam underlayment.

f) **Lining of motor hoods for trucks:** Large-sized and very deep-drawn pieces. Generally, moquette cemented to a rigid support.

g) **Upholstering of polyurethane seats:** Trimming is required. The material is very easy to cut, shapes are simple but actually tridimensional

h) **Molded-plastic seat-support structures:** A trimming application.

i) **Trimming of bumpers, front-end and rear-end shields, spoilers, etc:** These are large-sized, rigid, actually tridimensional pieces. They are generally injection-molded, requiring little more than the trimming of some parts (burrs).

j) **Cutting of anti-rust linings of wheel wells:** Small-sized but very deep-drawn pieces.

k) **Cutting of metacrylate deflectors for mounting outside the front windows:** These are small-sized but tridimensional pieces. Quality of cutting is essential, because the edge, being fully visible, must be polished and have no sharp edges.

l) **Cutting of aerodynamic linings underneath the car body:** These are large-sized, semirigid pieces.

m) **Cutting of furniture components, lamp shades and other items of furnishings.**

n) Cutting of motorcycle-riders' helmets and of protective helmets for civil and military uses.

o) Cutting of luminous and advertising signs in general.

p) Tridimensional cutting and trimming of lining components: For the water sports, motor vehicle, building, packaging and household electric appliances industries.

q) Cutting of containers in general.

r) Cutting and drilling of printed circuits.

As regards the cutting of metallic materials, the fields of use range from the automotive, to the military, to the maritime industries. The ZAC system finds optimum application to any type of production of metallic manufactures.

In particular, with regard to the automotive industry, it has the following applications:

A) PROTOTYPES. All the big automobile manufacturers spend several tens of thousands of hours a year on the marking out and cutting of body components for the building of prototypes. The pieces that must be produced range from a single unit to several tens of units for experimental preproduction models. These are always tridimensional, sometimes large-sized pieces, manually formed by metal workers, trimmed and then handfinished.

With the ZAC system, the marking-out operation can be avoided and replaced by a one-time programming of the machine, the trimming can be done in a very short time and the finishing operation eliminated owing to the very high quality of the cutting.

B) SHORT PRODUCTION RUNS. This is the typical case for industrial vehicles: Runs of 50 to 100 units a day for large-sized pieces. Considering that very often the average life of these models does not exceed 3 to 4 years, the difficulty of writing off these investments, which are not fully reconvertible once the production run is completed, is obvious.

Another typical case of short production runs is that of the customizing of individual units out of a large production run; for example, the "sun roof" versions of any model car, or the right-hand drive versions for the British markets, which have symmetrical holes for the pedals with respect to the regular production models.

C) SPARE PARTS PRODUCTION. Automotive manufacturers must guarantee the availability of replacement parts, for bodies as well, on the market for many years. This problem is resolved either by creating costly warehousing

facilities for replacement parts, or by preserving all stamping and cutting dies. The second solution is the one most generally used today; but, while for stamping, production runs being somewhat limited, cheaper resin dies can be substituted for costly steel ones, cutting and trimming dies continue to immobilize an unreasonable amount of capital for a production of a few hundred pieces a year. The ZAC system fully resolves this problem.

5. Conclusions

We trust this analysis of our tridimensional cutting system provides a sufficiently accurate idea of its applications. An assessment of the number of potential users of a system of this type is not an easy thing.

The fact is that although, until yesterday, advocates of the introduction of new technologies had very few arguments to use against the skepticism and circumspection of those who had to live with the day-to-day problems of production, today we are witnessing the advent of systems that utilize the power laser as an industrial tool.

Among these, the ZAC system provides a sure and tested response for those cases in which tridimensionality is a working requirement.

9399
CSO: 3698/425

STATUS OF RENAULT'S AUTOMATED FLEXIBLE WORKSHOP AT BOUTHEON

Paris L'USINE NOUVELLE in French 10 Jan 85 pp 47-48

[Article by Philippe Escande: "Versatile Shop--Boutheon 2 Years Later"]

[Text] The objectives have finally been reached. The shop now turns out at 80 percent of capacity. More than a year of effort for the maintenance men, and a lesson to remember: Designers, think a little more about maintenance!

To the point? Not to the point? The reliability of the flexible workshop at RVI (Renault Industrial Vehicles) has kept a lot of ink flowing since its inception 2 years ago. It's easy to criticize since the Boutheon shop faced up to an entirely new technology: it was actually the first of its type in France. While its total availability today reaches the initial objectives (in the vicinity of 80 percent), its birth was ticklish for the maintenance personnel. This is all the more true, considering the investment (45 million francs), since its "profitability" measured in terms of availability 24 hours out of 24 must be far above that of a conventional shop.

However, in this regard it has a substantial advantage over the traditional shop: the possibility of being able to "mask" the breakdowns or to operate in a reduced mode. For example, a shutdown of 10 minutes on one carriage has no effect at all on the availability of the unit, since the central computer makes use of the flexibility of the system to carry out the work on machines in good operating condition. Actually, they all have multiple capabilities, and none of them constitute a "hitch" capable of blocking all of the production. The line concept does not reign here!

Three men per station (there are two teams) are involved in maintenance around Denis Berthold, a young electronics engineer: two electricians and one mechanic, all three of them with a BTS [Superior Technician Certificate] or a DUT [University Technician Diploma], a technical level here well above that of a traditional shop. For the operation of the shop, besides the crew foreman, manufacturing has a shop engineer, two setup men, and three palletizers (the only job they have not succeeded in automating). During the day, an engineer is responsible for the first level maintenance of the shop.

Since the beginning, manufacturing and maintenance have stood side by side and involved the same training: close to 10,000 hours with the manufacturers

(SMC, Seiv Automation, Graffenstaden, etc.). This is an indispensable step considering the complexity of the equipment: four machining centers, one reaming-alignment machine, two convertible modular machines, all of them linked by self-propelled spindle-guided carriages and controlled in real time by a central computer.

All in all, this is not a case of practicing conventional maintenance. Actually, in this "shop of the third kind," the operator does not walk along the line, and accordingly the detection must be automatic. In fact, explains Denis Berthold, the machine controls itself and communicates every 6 seconds with the central data processor that the maintenance personnel refer to. In case of failure, the machine delivers a more complete diagnosis. This is a help (the machine indicates the operation concerned), but it is not a complete diagnosis, which is also more acceptable to the personnel.

The first steps were difficult and the training received proved to be too theoretical: "The principal difficulty," says Denis Berthold, "was the change of team between the manufacturers and ourselves, the users. It was perhaps somewhat abrupt." For example, this was the case for the adjustment of a spindle chart. "At the beginning, explains one of the engineers, it was always the manufacturer who made this adjustment. One night, when he was not there, the chart broke down. It was necessary to plunge into the documentation in the face of disaster. Actually, on-the-job training was lacking."

The great novelty was certainly the carriages, totally absent from the conventional shop. Two people were assigned full time to their maintenance. This fairly closely resembles that of robots: a large amount of prevention to avoid shutdown times as much as possible. In this case, not everything was provided for--far from it. It is often the simplest things that are forgotten. For example, the floor of the shop is particularly slippery because of the oil spots and other mists. Furthermore, it is not completely flat because the building is constructed on a marsh. Result: The carriages gave way to a veritable "stock car." In spite of their low speed, they skidded in the turns, all at once losing the contact with the data processing, provided by a wire buried in the floor. Almost a month of work was necessary to redo the floor with a synthetic resin and to reinspect the evenness of the surface.

All the elements of a flexible workshop are interrelated. Thus, the three machining centers can do precisely the same work. The maintenance man must know which of the three he can stop at every moment.

Another example: The machining center controlled by two automatic units which operate by the traditional sequential mode. However, they themselves are linked to an automatic unit responsible for the contact with the data processor. The maintenance is different, and nevertheless it is the same man who will have to repair both. A complex mode of operation that avoids any "hitch," with each machine able to continue to operate independently, i.e., without the help of the central data processing system.

Forgotten Strategic Element: The Central Supply

Another specific difficulty, another apprenticeship to be accomplished for the maintenance people and for their setup men: the methods of adjustment, which must be extremely rigorous. Actually, one machine cannot be adjusted relative to another as must be done in a traditional line, since each machine is independent and the path of the part is totally uncertain for the mechanic. Accordingly, he must use an absolute reference each time, especially since the tolerances required in total are 1/200 for a part that must be circulated among five different machines! Another thorn in the side of the manufacturers: "We think a lot about the 'noble' machines (milling, turning, etc.), but not enough about simple machines or components, which are nevertheless extraordinarily strategic." Thus, while the electronics of the carriages is marvelous, what can be said about their batteries, which it was necessary to change less than a year after being placed in service. Now if the batteries stop, it is the entire shop that is shut down.

Another more strategic element seems to have escaped the shrewdness of the analyzers: the cutting fluid supply which is located just above the entire shop. It is the only one, and if it stops, no machine at all is supplied. "A dramatic situation which definitely always occurs about 2 or 3 o'clock in the morning," emphasizes Denis Berthold. Cause of the stoppage: clogging by the chips. An incident that occurred two or three times and obliged the maintenance crew to modify the machine.

Let's not besmudge the picture to the ultimate. The times of rude awakenings in the dark of night, or of insoluble problems have lasted close to a year. The improvement today is perceptible in each of the weekly reports that summarize the production times and maintenance times for each machine. The production availability is briskly passing 80 percent, which corresponds to a production of more than 100 gearshift cases per day. This is a result that permits considering seriously the extension of the flexible workshop to the interior of the factory. One lesson to be remembered in any case: Designers, think a little more about maintenance, under the threat of helping to defeat the most audacious attempts at automation. Not everyone has the financial strength of Renault to wait for a number of years to amortize a very heavy investment. The only solution is serious reliability data that would permit designers to predict on the spot the operational availability of the shop starting in the first months. It is a question of survival.

[Caption] A production of more than 100 gearshift cases per day, a result that permits seriously considering the extension of the versatile shop.

[Caption] Working side by side and the same training for manufacturing and maintenance (close to 10,000 hours with the manufacturers). An indispensable step considering the complexity of the equipment.

12902
CSO: 3698/342

MICROELECTRONICS

FRANCE'S LETI REPORTS 1983 ELECTRONIC COMPONENTS RESEARCH

Grenoble LETI: RAPPORT D'ACTIVITE 1983 in French 25 May 84 p 3, 9-14, 15-16, 21, 23-27, 29-32, 79-80

[Excerpts from 138-page activity report of France's Laboratoire d'Electronique et de Technologie de l'Informatique, prepared by the Comite d'Orientation Scientifique of the LETI]

[Excerpts] [May 1984 Organizational Chart, p 3]

1. LETI Scientific Steering Committee--Chairman: M. Teillac, high commissioner for atomic energy.

2. LETI Management--Managing Director: J. Lacour. Assistants: I. Melnick, Scientific Affairs; E. Laviron, Contractual Relations and Public Relations (B. Hamon); C. Grenier, administrative and technical assistant.

3. General Services (SG)--G. Antier. Staff: 32 persons.

4. Materials Sector--P. Coeure.

5. Crystallogenesis and Materials Research Laboratory (CRM)--P. Coeure. Staff: 68 persons.

6. Electronic Components Sector--D. Randet.

7. Infrared Laboratory (LIR)--G. Guernet. Staff: 94 persons.

8. Input/Output Components Laboratory (CES)--G. Labrunie. Staff 71 persons.

9. Microelectronics Laboratories (MEL)--J. P. Lazzari. Staff: 140 persons.

10. Semiconductor Microelectronics Laboratory (MSC)--J. P. Lazzari. Staff: 75 persons.

11. Magnetic Microelectronics Laboratory (MEM)--H. Jouve. Staff: 55 persons.

12. Ways and Means Division (MG)--R. Micolet. Staff: 9 persons.

13. Instrumentation and Systems Sector--R. Gariod.

14. Autonomous Section for Physical Instrumentation and Metrology (IPM)--C. Sonrel. Staff: 20 persons.

15. Autonomous Section for Geophysical Applications and Interventions in Extreme Environments (AGIME)--P. Lemercier. Staff: 24 persons.

16. Measurements, Control and Electronic Processing Laboratories (MCTE)--R. Gariod. Assistants: R. Allemand, C. Axelrad, J. Max. Staff: 105 persons.

17. General Electronics Laboratory (EG)--E. Tournier. Staff: 37 persons.

18. Nuclear Electronics Laboratory (EN)--R. Allemand. Staff: 26 persons.

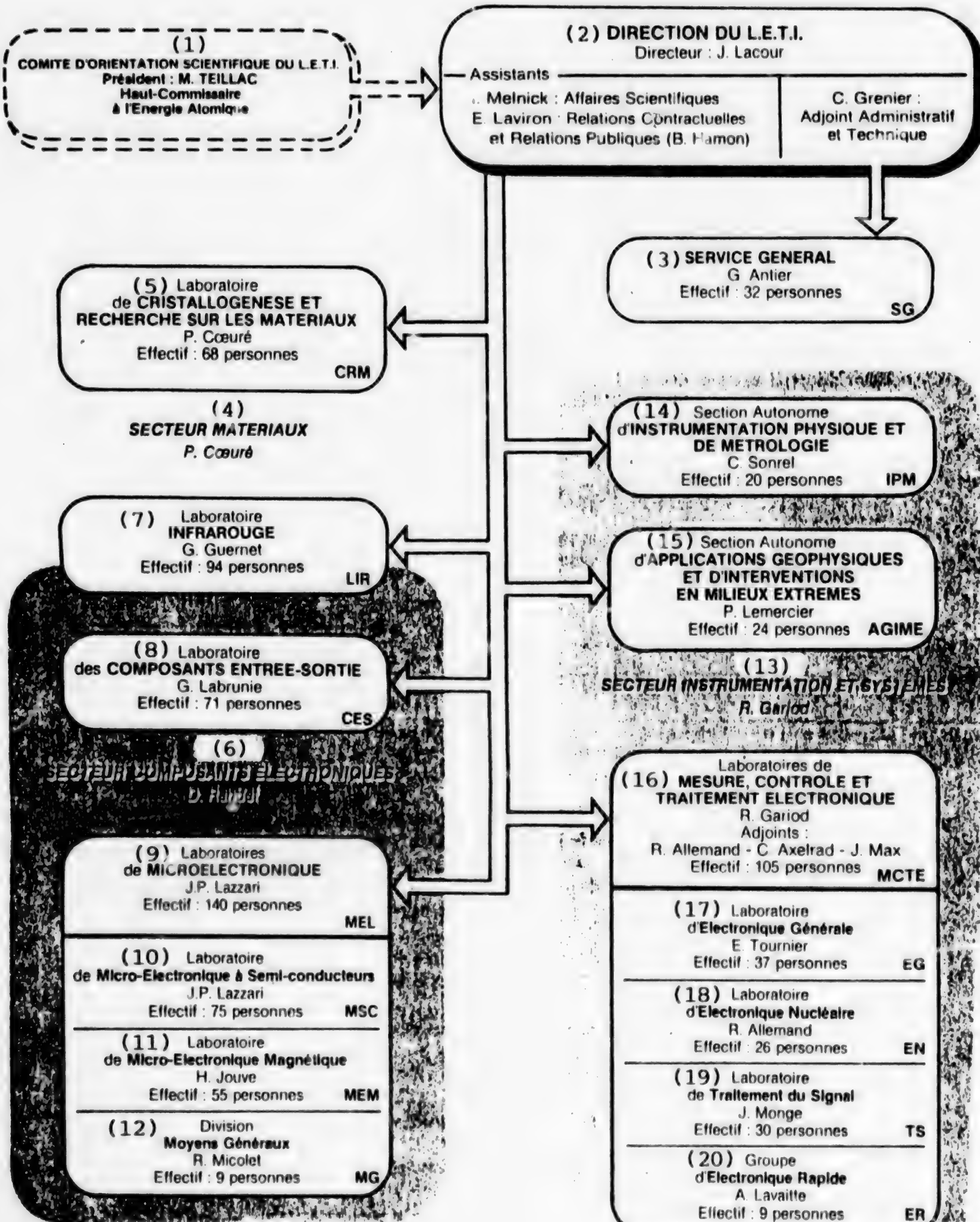
19. Signal Processing Laboratory (TS)--J. Monge. Staff: 30 persons.

20. Fast Electronics Group (ER)--A. Lavaitte. Staff: 9 persons.

[Chart follows]:

Electronics and Data Processing Technology Laboratory - LETI

<u>Organization Chart - May 1984</u>



[Overview of 1983 accomplishments, p 9-14]

Foreword

Despite the crisis that, in varying degrees, has gripped our industrial partners in their entirety, the LETI [Electronics and Data Processing Technology Laboratory-Grenoble], within the IRDI [Technological Research and Industrial Development Institute], has continued its development during the year that has just ended, in accordance with its intermediate-term plan. This plan, established for the first time in 1982, called for a restructuring in depth and a substantial augmentation of its staffing and facilities, to enable it to fulfill its role as a national laboratory in its domains of competency. The allocation of the financial resources placed at the disposal of LETI by the Office of the High Commissioner and by the public authorities must in fact not be made to directly reflect the current situation in industry. It is important to be able to jump ahead in the leading sectors, such as Microelectronics, Materials, Robotics, etc, sectors on which Government policy has clearly conferred a priority.

With approximately 400 employees as of year-end 1980, LETI's intermediateterm plan calls for stabilizing its staff at 650 employees as of 1987. As of year-end 1983, LETI had 525 employees and planned to increase this number to 585 by the end of 1984. Current authorizations total 575 plus 10 special employees hired in connection with the coming creation of an LETI IC [Integrated Circuit] Prototypes Shop. This operation having been decided, we will end up this year very close to attainment of our plan.

1. LETI's Microelectronics Building, on which work was started at the beginning of 1982, was completed at the beginning of 1984, on schedule and within budget as planned.

With most of its equipment and facilities already in operation, the building will be inaugurated in the very near future.

These new installations, together with those of the CNS [Norbert Segard Center] at Meylan, place Grenoble in a very strong international position. Most of the centers of the same nature that invite comparison, such as Louvain in Europe, and Stanford, Berkeley, and Cornell in the United States are either smaller in scale or in the process of being developed.

Despite its 6,000 square meters of laboratories, 1,500 square meters of which are clean rooms, LETI's Microelectronics Building is already proving barely sufficient to accommodate the staffs of the "Silicium" and "Magnetique" programs, taking into account the creation of the IC Prototypes Shop under the agreements with Thomson-SC [Thomson-Semiconductors], described later herein, and the launching of a new program on magnetic recording and mass memories.

A decision on the second section of the building is therefore indispensable as of now.

This will permit grouping on the same site the staffs of the Components Sector (except the LIR [Infrared Laboratory]) that are working on sensors, integrated optics and information display. This second section will necessitate the construction of a building of the order of 3,000 square meters. (The preliminary design study of this building is planned for 1984). Its modular design will permit meeting the requirements of future program developments.

Lastly, in this regard, the renovation of old buildings in the immediate vicinity of the Microelectronics Building is under way. This will permit grouping the entire Systems Sector, totaling 150 persons, in close proximity to the Microelectronics staffs, within the near term.

An analysis of the 1982 and 1983 budgets shows a substantial increase in operations expenditures as a result of staff increases for that item.

The investments rubric, on the other hand, shows a reduction, owing to completion of the construction of the Microelectronics Building. Major investments, however, involving the equipping of this building with machines, climbed steeply in 1982 and will continue high in 1984.

Funding of the 1983 budget will be provided to the extent of 50 percent by the AEC [Atomic Energy Commission]. Outside funding is divided up as follows:

--38 percent from administration sources in the form of program contracts and research agreements;

--12 percent from industry sources in the form of fees, direct contracts, various services, and sales of instruments and materials for research.

These percentages have remained very stable these last few years and it would appear very difficult to modify them significantly.

2. Important Events That Have Brightened the LETI's Life During the Past Year

Electronic Components Sector

Honors go to the efforts made to establish the LETI as a national microelectronics laboratory opposite French industrial colossi and the CNS.

As of year-end 1982, the results attained by the LETI with regard to the basic techniques of submicronics and in the 1-micron CMOS field of endeavor brought forth concrete offers of cooperation on the part of the two French colossi MHS [Matra-Harris Semiconductors] and Thomson-SC [Thomson-Semiconductors].

In a word, the AEC has chosen to strengthen the privileged tie that has existed with Thomson-SC, by signing a memorandum of agreement in February 1984, whose general outline is as follows:

The objectives of the Thomson-SC - AEC/LETI association will be defned by a joint committee. The executive directorship will be entrusted to LETI. The latter will bring together and stabilize in its "technological shop" its lines of endeavor that are to be transferred to Thomson-SC's lines of production.

In addition, a "prototypes shop" to be created on LETI's premises will permit the production in small batches of advanced-technology IC's [integrated circuit(s)].

To respond to the concerns of the Government administrations as regards avoiding the disadvantages of exclusive agreements, the Thomson-SC - AEC/LETI agreement provides for the possibility of transferring technologies developed in LETI's "technological shop" to MHS. Besides representing substantial economies, this will enable the two industrial giants, having the same technologies available to them as they will, to easily enter into secondsource agreements for their respective products.

In this same regard, the agreement also provides for the possibility of a cross-fertilizing transfer of technological endeavors and CAD [computeraided design] tools between LETI and CNS; this will strengthen cooperation between these two bodies.

These provisions leave LETI entirely free to fulfill its role as a national, indeed European, laboratory from the standpoint of the study of the basic techniques of the submicron technologies. LETI is entirely free to cooperate in this domain with any industrial entity of its choice, French or foreign.

It can also carry out any prospective study of its own in the domain of these endeavors, Thomson-SC having the right of first refusal with regard to the results.

In sum, the use of a portion of the "prototypes shop's" resources will enable LETI to carry out, for its own account or for that of its equipment-manufacturing industrialist partners, research activities in the domain of circuits and systems that until now have been denied it for lack of suitable equipment and facilities.

In the domain of magnetic microelectronics, LETI has for many years been seeking other points of application of its capabilities. In fact, if the magnetic bubbles program develops very promisingly, this effort having been taken over by our partner SAGEM [Company for General Applications of Electricity and Mechanics], it will be necessary a few years hence to think of a revival.

Work on magnetic recording applied to mass memories, a much-neglected area despite its major importance, was undertaken in view of LETI's current expertise, and, more generally speaking, that of Grenoble, in the domain. The reorientation of the Josephson program towards applications in metrology and instrumentation, which are more specifically interesting than its application to IC's, made it possible, as compared with the initial outlook for the microelectronics program, to release the funds needed to launch this ambitious new program.

Submitted for the first time to the Government administrations concerned in 1983, it was very favorably received. A position taken recently by Bull through the voice of its president strongly encourages LETI, which is functioning in this domain also as a national laboratory.

An initial industrial project, the Micromag project, proposed by Mr Lazzari, will include the AEC and Bull and will be the first point of application of this program.

In the domain of flat-screen display, the difficulties encountered since the end of 1983 are not of a technical nature. LETI, retained to prepare the first generation of screens for the Planetel Company, a subsidiary owned 50/50 by CGE [(French) General Electric Company] and the AEC, fulfilled its contract to the letter.

The generation that followed, involving color, shows promise, as do other much more advanced solutions which LETI is preparing as part of its national mission.

The present difficulty stems from the hesitancy the industrial operator CGE has shown for several months now.

The situation thus requires finding another partner, with the aid of the DAII [Directorate of Industrial and International Affairs (of the DGT [General Directorate for Telecommunications])] and the DIELI [Directorate for the Electronics and Data Processing Industries], in view of the interest of both these agencies in this project.

Materials Sector

Several gratifying accomplishments merit citing in this domain. The internal restructuring begun in 1982 yielded its fruits in 1983. The efficiency of the teams showed a marked improvement and the enthusiasm of the researchers was stimulated by the interesting technical results, particularly in the domain of lasers, gallium arsenide and submicron-bubble materials.

After 2 difficult years, the rapid expansion of CRISMATEC, a jointly owned subsidiary of Rhone-Poulenc and the AEC, began to take shape in 1983 and was confirmed in 1984. The 3-year crash plan backed by the Government administrations and designed to give CRISMATEC its chance will be coming to a highly

successful end. A new 3-year plan, the object of which is to prepare the production of future products, is now being drawn up. CRISMATEC, the sole French supplier of advanced-technology materials for electronics, has good chances of succeeding.

This assessment rests in part, of course, on LETI, which, in agreement with its subsidiary, prepares the new materials and processes it will need.

All these gratifying results must not be allowed to mask the serious financial difficulties that currently beset LETI's materials teams. For several years now, this activity has been paralyzed by too low a level of funding. The Industry Ministry's materials pump-priming program is being delayed. We express our hope here that, in 1984, this program of foremost importance for the future of French industry can be put into effect tangibly.

Instrumentation and Systems Sector

The financial difficulties being experienced by the CGR [General Radiology Company] are causing that company to interrupt the joint program under which our two companies have worked together for the past several years and which has enabled that company to offer a top-of-the-line X-ray tomography machine, the CE 10,000.

Just when, based on work done by LETI on simplified X-ray detectors, CGR has announced a new line of optimized tomography machines the market for which appears promising (200 machines in France over the next 3 years), it seems to us regrettable that this cooperation is being brought to an abrupt end for reasons having nothing to do with the quality of work that has been done.

Other industrial partners are taking over from CGR in domains more advanced than X-rays. We refer to the Societe Nouvelle Informatek, on which we are counting to cover the industrial aspects of on-the-fly positron tomography. This company will take over as soon as the two machines planned for Lyon and Caen are launched.

And with respect to NMR [nuclear magnetic resonance], in addition to very important isolated contributions with regard to generation of fields using permanent magnets, made jointly with UGIMAG, a subsidiary of PUK [Pechiney-Ugine-Kuhlmann Company], LETI has taken a phase lead by concentrating on spectroscopic imaging, which promises to yield fallouts in connection with certain AEC programs (ORIS [expansion unknown], SHFJ [expansion unknown], IPSN [expansion unknown]).

Worthy of mention also is the important contribution LETI intends to make in the robotics field, in which AEC is assuming nationwide responsibility for work in connection with environmental extremes. The experience we have gained in robot vision systems will constitute a significant part of this endeavor. It will be supplemented by that of our onsite intervention teams in geophysical and underwater environments, which in very many cases involve

the design and construction of special-purpose robots for operation in environmental extremes. An excellent example is the shuttle for the gathering of nodules, under the GEMONOD project, which brings together the AEC and the CNEXO [National Center for Exploitation of the Oceans].

During 1983, many exchanges of views took place between LETI and the various operational units of the IRDI [Technological Research and Industrial Development Institute] working in the nuclear domain. As a result of these exchanges a certain number of techniques in which our laboratory has developed expertise, such as detection, signal and image processing, shape recognition, and hostile-environment robotics, have been found suitable for transposition to the different stages of the nuclear cycle: Prospection, fuel, reactors, reprocessing and waste disposal. Several working groups have been formed.

Conclusion

Experience has shown us that the cooperation formula being offered by LETI to French industrialists meets their needs in a large number of cases. To handle this increased demand both for raising the level of existing joint operations and for the launching of new ones, LETI must continue its growth in the coming years. Confident though we are of the quality of the service we can render to the industrialist in the preparation of his intermediate-term future, we want to express here our fear of seeing the financial resources needing to be invested underestimated by the Government authorities as well as by the industrialists concerned.

[Work in gallium arsenide, other materials, pp 15-16, 21, 23-27]

I. Materials Sector

1. Introduction

LETI's fields of expertise are situated in the domain of Materials Engineering and are being applied to materials for electronic and optoelectronic components.

They include:

--Scientific and technical know-hows:

- Processing methods and means (crystallogenesis machines),

- Packaging methods and means,

- Analysis and testing of properties to determine their suitability for the applications contemplated;

--Implementation of transfers to industry;

--Commercialization under the trade name CRISTAL TEC (registered trademark of the AEC [Atomic Energy Commission]).

A distinction is generally made between two levels of research:

a) "Upstream" research: Fundamental research and basic research:

--Materials science and engineering;

--Materials for electronics and optoelectronics;

--Characterization.

b) Predevelopmental research, particularly for the CRISMATEC Company, a subsidiary of Rhone-Poulenc Industries and the AEC. Table 1 shows a list of the materials manufactured by CRISMATEC including those produced on the basis of processes developed by LETI.

2. Magnetic Materials

Effort has been centered essentially on the processing and characterization of materials for magnetic bubble memories.

The 1-Mbit memories presently being marketed use "epitaxied" materials characterized by bubble diameters of 1.8 to 2.2 microns. The range of operating temperatures extends from 0 to +70°C.

Memory chips with a capacity of 4 Mbits are in the course of development by various companies. In the very near future Intel will be sampling memories with bubble diameters of 1.3 micron (conventional technology using Permalloy propagation patterns), whereas LETI is seeking to develop more compact memories with bubble diameters of 1 micron (technology using propagation patterns obtained by means of ion implantation).

3. Semiconductor Materials

3.1. Gallium Arsenide Crystallogenesis

The industrial importance of the III-V materials AsGa and InP is becoming increasingly manifest. Mastery of the semi-insulating material AsGa is the key to development of IC's [integrated circuit(s)] 2 to 5 times faster than those based on silicon. And the obtention of good-quality InP crystals is a key point in the development of optical communications beyond 1.06 μ.

LETI's studies aimed at developing monocrystal manufacturing methods have as their objective the achieving of national self-sufficiency through the creation of a French productive capability. The CRISMATEC Company could be the producer, in which case its expertise in the field of crystallogenesis could well boost it to the rank of top European supplier.

Table 1

Monocrystals Manufactured by CRISMATEC

MATERIAUX (1)		APPLICATION (9)
■ Gallate de Gadolinium (2)	Ø 75 mm	■ Substrat de mémoires à bulles magnétiques (MBM)(10)
■ Gallate de Gadolinium substitué (3)	Ø 75 mm	■ Substrat pour films magnéto-optiques (11)
■ Couches minces épitaxiées de grenats (4)	Ø 75 mm	■ Film magnétique pour MBM. Bulles Ø 2 μm (12)
■ Couches minces de YIG (5)	Ø 50 mm	■ Films magnétiques pour filtres magnétostatiques (13)
■ Niobate de lithium (6)	Ø 50 mm orientation Y + 128	■ Filtres à ondes de surface (14)
	Ø 50 mm orientation Z	■ Lignes à retard (15)
■ Tantalate de lithium (licence CNET) (7)	Ø 50 mm orientation Y	■ Filtres à ondes de volume (16)
■ Germanate de Bismuth (8)	Ø 70 mm	■ Scintillateurs (17)

Key:

1. Materials.
2. Gadolinium gallate.
3. Substitution gadolinium gallate.
4. Epitaxied thin layers of garnets.
5. Thin layers of YAG.
6. Lithium niobate.
7. Lithium tantalate (CNET license).
8. Bismuth germanate.
9. Applications.
10. MBM [magnetic bubble memory] substrates.
11. Substrates for magneto-optic films.
12. Magnetic films for MBM.
13. Magnetic films for magnetostatic filters.
14. Surface-wave filters.
15. Delay lines.
16. Volume-wave filters.
17. Scintillators.

During 1983, work continued on optimization of the Czochralski process for the pulling up of AsGa crystals. We researched an improved method of testing arsenic's stoichiometry. The purity of the crystals obtained from the basic materials provided by different suppliers was evaluated. We have achieved reproducibility of AsGa crystals 52 mm in diameter from a starting charge of 1 kg of material (Fig 3 [not reproduced here]).

Cooperative arrangements have been instituted with different entities:

--Thomson CSF [Thomson-General Radio Company] (Central Research Laboratory and DCM [Central Directorate for Ordnance] Corbeville);

--INSA [National Institute of Applied Sciences] of Lyon, for photoluminiscence. We would also like to work together on the characterization of AsGa crystals doped with vanadium, to determine the nature of the cores induced by this doping agent;

--University of Languedoc-Roussilon, for the characterization of imperfections by thermal excitation and visual display of crystalline faults by infrared imaging;

--Working contacts with the LAAS [Automation Technology and Systems Analysis Laboratory] and the CNET [National Center for Telecommunications Studies] Bagneux, for the supply of AsGa substrates for epitaxy (molecular jet and gaseous phase epitaxy). These tests will improve our knowledge of the quality of our smoothing technique and the thermal stability of the material in gaseous phase epitaxy case.;

--Fundamental Research Department of the CENG [Nuclear Research Center-Grenoble], for photoluminescence; and

ENSERG [National Superior School of Electronics and Radioelectronics at Grenoble], for the Hall effect in an intense field.

3.2. Germanium

A process has been studied for the pulling of crystals of large size and large diameter (90 mm), for application to infrared optics and neutron monochromators.

3.3. Research on Crystal Growth Methods: Deposit of Thin Layers of Zinc and Cadmium Sulfides in Aqueous Solution

This program, implemented jointly with the CNET Bagneux, has as its objective the deposit of thin polycrystalline or monocrystalline layers ($\simeq$0.5 μm) of zinc or cadmium sulfides by atomic layer-by-layer growth, in aqueous solution, after adsorption of cations and corresponding anions by successive immersions in electrolyte solutions containing these ions.

3.4 Piezoelectric Materials

Work, in conjunction with CRISMATEC, has centered essentially on the development of methods of manufacturing lithium niobate. The feasibility study on zone melting crystallization, in which heating is supplied by a flat resistor, has continued. Crystals 25 mm in diameter and 50 mm long have been manufactured. A prototype of a production machine designed to process crystals 200 mm long and 75 mm in diameter has been built (Fig 5 [not reproduced here]) and is operating satisfactorily.

4. Materials for Infrared Devices

This activity is directed toward the study, processing, packaging and physicochemical characterization of bulk and thin-layered infrared materials.

--Using semi-unchanging methods, LETI's LIR [Infrared Laboratory] processes bulk materials for its own needs and those of French industrialists. These materials include:

- Highly purified silicon (residual levels of borium and phosphorus lower than 10^{12} cm^{-3}) obtained by zone melting;

- Extrinsic indium- and selenium-doped silicon, enabling the laboratory to design and build mosaics of photoconducting detectors (spectral window 3 to 5 µm; complexity 32 x 32 elements) and to display the first infrared images;

- Pure cadmium telluride, processed in a diameter of 45 mm, the use of which is dual: The polycrystalline portions of the ingots are used by the LIR and industrialists as basic elements for the manufacture of cadmium-mercury telluride (infrared radiation detecting material); the monocrystalline zones, after orientation (<111> at an angle of 20'), cutting and polishing, provide the basic substrates for epitaxial layer studies;

- Pure mercury telluride, monocrystalline, 45 mm in diameter, used primarily for the metallurgic laboratory's own needs.

--Studies of thin-layer epitaxy of cadmium-mercury telluride on cadmium telluride substrates are being carried out at two levels: Exploratory research and fabrication.

5. Optical Materials and Microstructures

Research on new laser matrices has yielded two original results.

With the ENSCP [National Superior School of Chemistry, Paris], the laboratory has undertaken crystallogenesis of the aluminate $La_{0.9}Nd_{0.1}MgAl_{11}O_{19}$ (called LNA) by the Czochralski process.

Monocrystals of good quality have been obtained and right-angled parallepipeds 6 x 6 x 100 mm^3 have been cut along the optical axis. These samples, numbered LNA 1,2 and 3, were tested in a laser cavity at CNET Bagneux by Mr Auzel. The curves of emitted laser power as a function of incident power are shown in Fig 6 [not reproduced here]. The highest efficiency, that of LNA 1, is around 3 times higher than that of neodymium-doped YAG [yttrium-aluminum-garnet]. However, before LNA's potential for real application can be evaluated, it is desirable not only to optimize its crystallogenesis, but also to evaluate its thermal conductivity and the variations of its properties with temperature.

Another promising result: Still together with CNET Bagneux, a study is under way to obtain crystals of Ni^{2+}-, Co^{2+}- or V^{2+}-doped MgF_2. We are seeking to determine the laser effect in the following concomitant ranges:

--For V^{2+}: 1.07 to 1.2 microns;

--For Ni^{2+}: 1.62 to 1.73 microns;

--For Co^{2+}: 1.64 to 2.1 microns.

The laser effect at 1.62 microns was demonstrated using 2-percent-nickeldoped MgF_2 in a crystal made by the Bridgman method. Tests are in progress on other, fluorine-doped crystals, particularly as regards $LiYF_4$.

Lastly, as part of our exploratory research, we have continued the study of the feasibility of optical microresonators. The potential of these small-dimensioned structures (of the order of 1 micron) for use in possible optical information-processing systems has been examined from a theoretical standpoint.

6. Characterization

The Characterization Group of LETI's CRM [Crystallogenesis and Materials Research] Laboratory provides LETI and other outside entities with characterization facilities in the following domains: Transmission and scanning electron microscopy, X-rays, magnetic optics and characterization, RBS [Rutherford backscattering] and ESCA [Superior School of Applied Chemistry], and more recently the micro-Auger domain.

[Components research, pp 29-32]

II. Components Sector

1. Introduction

The distinction between basic techniques and application programs, which has been made since 1980, has brought out the essential role of basic

microelectronic techniques in the components sector programs, particularly as regards four of them:

--Silicon IC's [integrated circuit(s)];

--Magnetic bubble memories;

--Magnetic recording;

--Infrared imaging.

Hence the decision arrived at in 1981 to group the first three of these in a suitable building, the fourth having already been provided with large-scale new facilities. Actually, the initial list included Josephson IC's and not magnetic recording. We shall come back to the reasons for this change.

Other programs, namely:

--Integrated optics,

--Display systems,

--Sensors, and

--Josephson devices,

also use techniques related to microelectronics, so that the components sector forms a homogeneous whole as regards technology.

This whole requires very sizable investments in order to be regarded as world-scale in a discipline that demands ever more accurate, more complex and more highly specialized machines. There is no inherent difference between LETI's machines and those of industry. The sole performance criterion that perhaps can be somewhat sacrificed is production output, all other criteria being, on the contrary, altogether pace-setting.

The years 1982-83 were very demanding, in that it was necessary to fully equip the silicon microelectronics laboratory. This fundamental effort will be continued in 1984, with installation of the laboratory in the Microelectronics Building.

The crash program drawn up in 1981-82 to position this silicon microelectronics laboratory as an effective aid to industry has achieved its goal. The key stage in the assembling of a "true" 1-micron CMOS line of endeavor was attained in 1983, as planned. New relations are in the course of being established with Thomson and MHS [Matra-Harris Semiconductors]. As regards machines, the cooperation of several years standing with CIT [International Telephone Company] has developed into a veritable industrial operation, with RIE [Reactive Ion Etching] machines selling well in France and abroad.

It should be mentioned that the mask-generating facility was fully operational in 1983. It fulfilled its purpose of being able to supply LETI rapidly with the necessary masks, despite problems encountered in the use of the Philips masker to produce high-definition complex masks covering large areas.

As regards magnetic bubble memories, there has been no inherent change in the situation and the planning done in 1982 remains valid. LETI is concentrating on the second generation, that of 4- to 16-Mbit memories, with the use of ion implantation for the storing of higher-density information (technique known as DNI [unimplanted disks]). American and Japanese manufacturers appear to be taking the same approach, having experienced problems in the use of conventional permalloy technology to produce 4-Mbit memories (this was the initial choice made by Intel, with start of the production stage currently running behind schedule). With SAGEM [Company for General Applications of Electricity and Mechanics] supplying 1-Mbit products, the transfer of a 4-Mbit technology can be planned.

With respect to magnetic recording, LETI announced in 1982 its intent to relaunch a program of studies, aimed at instituting a French industrial capability commensurate with the size of this sector of activity. A small team was formed in 1983. Talks entered into with the industrialists concerned, in liaison with the services of the Ministry of Industry and Research, are expected to reach a conclusion in 1984 that will confirm an operation having as its primary object the development of products in the new perpendicular-magnetization sphere of endeavor, making as much use as possible of technical synergies with silicon microelectronics technology.

In infrared imaging, LETI's LIR [Infrared Laboratory] fulfilled its mission of supplying components (test pieces and mosaics for detection and reading). It reached an important milestone in its program with an imaging demonstration using hybrid, 32 x 32 element, photodetection-reading mosaics. Lastly, the planned industrial links under the antitank homing guidance systems program were reexamined and the decision reached to advance the transfer stage.

The Josephson program was entirely reviewed, LETI's team having by now gained sufficient knowledge of the technology and performance of the different approaches studied abroad to be able to render an opinion regarding the endeavor in its entirety. This examination produced the following findings:

--The integrated-circuit approaches being followed especially by IBM could not produce the combination of the four qualities (reproducibility, reliability, high speed, integration) necessary for converting the potential advantage of the Josephson technology into a real advantage;

--The basic element, namely, the junction, and in particular the tunnel barrier, had not really been mastered by any team, making it appear premature to attempt the realization of IC's [integrated circuits];

--Josephson effects could be applied more simply and more needfully to advanced-technology instrumentation, where their performance is indisputably very superior to that of the other techniques.

It was therefore decided, in May 1983, with the backing of the DRET [Directorate for Research, Studies and Techniques] and the DESTI [Directorate for the Scientific and Technical Development of Innovation], to reorient this program by limiting funding to the realization of three objectives:

--Development of a reliable and reproducible technology for realizing the basic elements (junctions);

--Study of already promising applications in advanced-technology instrumentation, in liaison with the Systems sector;

--Development of our capability for evaluating the progress being made by foreign teams in the direction of IC's.

Consequently, the Josephson group was organized as two teams: One for basic technology, and the other for devices; their total staffing was reduced to 14 persons.

The halt in the development of Josephson approaches announced by IBM in November 1983 rather confirmed the soundness of our own reorientation, IBM having also decided to continue its basic studies, and the Japanese theirs, both maintaining IC's as their goal.

In display technology, LETI's work was judged sufficiently significant for the Technical Committee on Electronics to request that we develop a national program applied principally to flat screens.

The first element of the national program, that which today mobilizes the largest number of persons, consists of the transfer to Planetel of components in the BCE [expansion unknown] line of endeavor, which is expected to lead rapidly to the realization of flat screens usable with, initially monochrome, then color, terminals. The first stage of the Planetel program consisted of demonstrating a technical feasibility. This stage was attained as of the planned date, year-end 1983, by the connection to the Minitel network of a flat screen fully compatible with that network's standard (images of 250 x 320 points, texts of 25 lines of 40 characters each, 8 levels of gray, video input).

The rest of the program is proceeding as planned. The future importance of liquid-crystal integrated-screen technologies was confirmed by the introduction in Japan, in October 1983, of numerous models of colorTV miniature screens. Alas, this also bears out the Japanese lead.

LETI's program has had to be sufficiently ambitious, since it aims at total integration, whereas current Japanese realizations separate the screen from the control circuits. The parallelism between the work being done based on

the conventional monocrystalline silicon technique--with wafer-scale integration and redundancy--and that based on the new technique of transistors in thin layers should buy some time. As should also the cooperation in the course of being set up with CNET Lannion.

And lastly, current exploratory work on integrable active screens could open a new field of endeavor that would be an alternative to the developmental work being done by several foreign teams on flat cathode-ray tubes and their derivatives.

In sensors, the results obtained have demonstrated the paradoxes inherent in working together with the PME [Small- and Medium-Sized Enterprises] sector. LETI's program centers on enterprises of this type, which are undoubtedly the best suited to develop sensors designed to serve a specific market niche. In fact, the results have been quite spectacular. Two years after being licensed to produce a new type of hygrometer, CORECI [Industrial Control and Regulation Company] has sold over 10,000 units, 60 percent of them as exports, and plans to reach the 100,000 mark in 1985. As of year-end 1983, Terraillon was producing 500 LETI electronic-sensor balances a day.

The paradox is that these successful operations:

a) Are among the least well-funded, the grants in aid for sensors being more tailored to university studies than to research and development operations;

b) Are at risk of asphyxiation by their very success, which can mask the need to prepare improved sensors without delay, so as to retain the market niche they have succeeded in capturing. The PME's, however, do not have the R & D facilities to do this kind of work, which is definitely LETI's domain. And in offering subsidies of an industrial nature, since what is involved is the improvement of an existing product, the government administrations concerned are failing to respond to the realities of the situation.

In integrated optics, the first stage of concretization of the technology was completed with the building of a fully operational mock-up of a spectral analyzer and of multiplexing networks for optic telecommunications. Application programs were organized, together with the users, for the years 198485, in signal processing, optic telecommunications and fiber sensors.

Wiring termination technology, being a general support technique, interacts with many programs. Together with the industrial development of the CACIS [expansion unknown], a development that continues difficult, the change of licensee having been made not without delaying certain operations, the wiring termination technology group continues to deal with the specific problems posed by new devices--currently, the wiring termination technology associated with flat screens and test facilities for infrared components. It is important to have available this array of expertise and facilities, although it rarely gets primary consideration in the organization and funding of programs.

Fields of Basic Expertise of I & S Sectors

(1) Capteurs et métrologie

(2)— Rayonnements nucléaires
(3)— Ultrasons
(4)— Optique
(5)— Magnétisme RMN, RPE
(6)— Hyperfréquences

(7) Méthodes

(8)— Traitement du Signal
(9)— Traitement des images
(10)— Reconnaissance des formes
(11)— Electronique rapide
(12)— Electronique très faible consommation

Key:

1. Sensors and metrology.
2. Nuclear radiation.
3. Ultrasonics.
4. Optics.
5. NMR, EPR megnetism.
6. Hyperfrequencies.
7. Methods.
8. Signal processing.
9. Image processing.
10. Recognition of shapes.
11. Fast electronics.
12. Very-low-power electronics.

Fields of Application

(1) **Génie Biologique et Médical**
(Imagerie Médicale)

(2) **Instrumentation scientifique**
(3) ■ Magnétométrie
(4) ■ Localisation des rayonnements
(5) ■ Architecture informatique
etc...

(6) **Instrumentation Industriel**
(7) ■ Visionique (Robotique, Inspection, CND)
(8) ■ Equipements et méthodes pour l'Off shore
(9) ■ Ramassage de nodules
(10) ■ Géophysique

Key:

1. Medical and Biological Engineering (Medical imaging).
2. Scientific Instrumentation.
3. Magnetometry.
4. Radiation detection.
5. Data processing architecture, etc.
6. Industrial Instrumentation.
7. Vision technology (robotics, inspection, direct numerical control.
8. Equipment and methods for offshore operations.
9. Gathering of nodules.
10. Geophysics.

[Instrumentation branch, pp 79-80]

III. Instrumentation and Systems Sector

1. Introduction

LETI's Instrumentation and Systems [I & S] Sector develops the basic techniques in its domains of expertise, and endeavors to put them to use in the different domains of application enumerated herein [see accompanying charts]. It also utilizes the expertise developed in LETI's other sectors (Materials and Components Sectors).

A primary mission of LETI's I & S Sector is to contribute to the different programs of the AEC's [Atomic Energy Commission('s)] units, in its fields of basic expertise, by resolving certain high-level technological problems (Example: Testing of fuel pin welds by automatic recognition of flaws, positron tomography for SHFJ's [expansion unknown] medical research, X-ray tomography for nondestructive testing by the DAM [Military Applications Directorate]...). A privileged relationship has been in place for some time now with the IRF [expansion unknown] for the detection of radiations by means of multidetectors; it is being continued through coordinated research actions (bidimensional electrophoresis).

A second mission is to establish ties with the funding and national research coordination bodies, to ensure the dovetailing of our programs with the national research effort (Examples: MIR [Ministry of Industry and Research], DIELI [Directorate for the Electronics and Data Processing Industries], ADI [Association for the Development of Data Processing], INSERM [National Institute of Health and Medical Research], etc...]).

A third mission is to develop our research programs in connection with industry and other public entities (Intertechnique, Crouzet, CGR [General Radiology Company], as well as the CNES [National Center for Space Studies] and the BRGM [Bureau of Geological and Mine Exploration]).

Physical and Medical Instrumentation

From a national standpoint, although the need for a sustained scientific instrumentation effort is becoming increasingly evident, the lack of a corresponding industry is abundantly clear.

In the medical sector, industrial activity in the field of major instruments (imaging systems, in particular) is limited to a single firm that is interested only in meeting the most immediate needs.

Analysis of this situation warrants the observation that, on the one hand, advanced-technology-instrument needs for research, both "physical" and "medical," justify LETI's current activity, and, on the other hand, that this

advanced research is constituting an indispensable reserve for a subsequent industrial development effort.

There is a large degree of identity between the problems posed both by "physical instrumentation" and "medical instrumentation." For example, all modern imaging methods are dependent upon mastery of the "physical phenomena" used for imaging in the latter case (ultrasonics, radiation, magnetism, hyperfrequencies, etc...), which obviously are found in the corresponding "physical" instrumentation case.

Vision Technology and Robotics

Since 1982, the AEC has been engaged in a robotics activity, and it is from this standpoint that LETI has planned to develop its vision technology activity. Vision technology, with the acquisition of an image as its basis, enables the automating of decisions in the domains of robotics, inspection and nondestructive testing. Vision technology contributes major proportion to the I & S Sector's fields of basic expertise, and is becoming one of its major areas of research.

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CSO: 3698/453

LEADING-EDGE MICROELECTRONICS RESEARCH AT SWEDEN'S CHALMERS

Ion Implantation, SOI

Stockholm TEKNIK I TIDEN in Swedish No 1, 1985 p 4

[Article: "Atoms Injected into Silicon Crystals"]

[Text] In the search for more and more effective integrated circuits, transistors are being packed more and more densely on silicon chips. The most advanced circuits being tested today may have 1 million transistors on a 0.5-cm^2 area. Researchers will soon reach a limit where the dimensions cannot be further reduced without the appearance of new--both good and bad--phenomena.

Another way to pack transistors more densely is to construct circuits in three dimensions instead of two. In this way, layers and layers of transistors are placed together. Such circuits are difficult to construct, but provide greatly increased possibilities.

Researchers at Chalmers are working with semiconducting material for circuits of this type. Under the leadership of Asst Prof Gillis Holmen, the researchers at Chalmers have taken a position on the leading edge of studies on the use of ion implantation as a doping method for semiconductors.

Doping Atoms Injected

Powerful accelerators are used to inject ions into silicon lattices. Unlike the old diffusion technology, the new technique provides good control over the quantity of doping atoms and their distribution in the crystal.

The energy of the ions determines how deeply they penetrate into the material. Ion implantation has great advantages and is not the predominant doping technique. It is now used in most well-equipped semiconductor laboratories.

"Bombardment with ions creates radiation damage in the crystals, however, and we here at Chalmers are especially interested in this damage and activation of the doping atoms," Gillis Holmen said.

New Methods Developed

"In order to repair the damage, we have developed a new method in which ion beams are used in the healing process. This method has shown itself to be quite useful. The exposure temperature can be held as low as 200 to 300°C, which is a great advantage. Studies with this new method have also yielded results in the area of basic research, especially concerning the mechanisms by which the damage is repaired."

Other methods of repairing the damage include heat treatment in a furnace at 600 to 1,000°C. But this high temperature can also have undesired effects. High-temperature treatment will be impossible in the advanced circuits of the future.

World's Record In Low Temperature

The laser method is also used, but it has the disadvantage of causing certain defects in the material. Research at Chalmers has shown, however, that proper preparation before laser irradiation can prevent defects.

The ability to work at lower temperatures is extremely important, especially with respect to production of the densely packed advanced circuits of the future.

"We have produced a transistor with a maximum temperature of 420° in the most sensitive production stages. This probably is a world's record," Gillis Holmen said.

Silicon On Insulators

His research group at Chalmers is also working with the advanced material that consists of silicon on insulators (SOI). The advantage of this material is that each electronic component can be constructed in isolation from the others and, in this way, it is possible to pack the components more densely.

Higher speed and lower power consumption per component are other advantages of these new materials.

In Sweden ASEA-HAFO is using an SOI material, silicon on sapphire (SOS), to produce electronic circuits in so-called "custom design" projects. This means that the customer is primarily responsible for designing the circuit, which is then produced by ASEA-HAFO.

This method has many economic and patent-related advantages.

Cheaper Material

"We would like to replace the expensive sapphire material with something else. By ion implantation of nitrogen or oxygen into silicon, for example, we could produce a layer of silicon nitride or silicon oxide within the material with

good insulating properties," Gillis Holmen said.

This method can be developed to include several insulator-silicon layers of this type, making it possible to produce three-dimensional components, thereby increasing the component density even more.

The long-range goal of the Chalmers research group is to develop new materials of this type.

Valuable To Industry

"One problem we have in research and teaching today is that, unfortunately, the economic upswing has meant the loss of many doctors and engineers to the industry in Sweden or in the United States. We would like to see them stay in the schools several years longer to help train our students."

"The future of the electronics industry in Sweden is totally dependent on better training at all levels for a growing number of people in the area of semiconductor electronics," Gillis Holmen said.

"We are working in a field of research in which Sweden actually has a chance to be on the leading edge in the international context. This will be highly beneficial to the electronics industry," he said.

III-V Compounds

Stockholm TEKNIK I TIDEN in Swedish No. 1, 1985 p 5

[Article: "GaAs Provides New Possibilities for Information Technology"]

[Text] Silicon is the most common semiconducting material. It is inexpensive to construct integrated circuits with silicon. The industry's production apparatus is also designed primarily for the use of silicon in the mass production of semiconductors.

Gallium arsenide (GaAs) is a new semiconducting material that is already extremely valuable in certain specialized applications.

GaAs has several advantages over silicon. Its electron mobility is five times higher and, as a result, computers made with GaAs circuits are much faster. But GaAs may be seen as something more than a material for faster computers. As an example, it may be used for the transfer of large quantities of data, such as in satellite communications. This requires discrete components, such as diodes, that may operate at extremely high frequencies--in the microwave range.

A third example of the use of GaAs is in lasers, which serve as light sources in fiber-optical communications systems.

"GaAs provides a new dimension in information technology. This material may be seen as a cornerstone in the ongoing technological revolution. It is the

road into the information society."

This was stated by Asst Prof Thorwald Andersson of the Physics Institute at Chalmers.

A new laboratory for semiconductor research has been established at the institute under his leadership. The laboratory is built around an MBE (molecular beam epitaxy) system for producing and studying so-called group III-V compounds. Gallium arsenide is a compound of this type.

MBE often refers to an extensive process. It begins with substrate processing: polishing, cleaning, and etching. The substrate is stored in a sluice chamber in the MBE system for later sluicing into the growth chamber. Here the epitaxy occurs by evaporation from a number of sources, one for each element that is built into the crystal during its growth. The main elements used are gallium, aluminum, arsenic, and silicon.

The precondition for epitaxial growth is that the substrate surface must be atomically pure. The composition of the layer is controlled by previous calibration of the flow of evaporated material. This is based on the electrical and optical characteristics of the semiconductor material.

The composition of the outer layer of atoms is measured by a so-called Auger spectrometer in the growth chamber. Electron diffraction (RHED) is used to monitor the geometric structure of the outermost layer of atoms. This is where surface physics enters the picture.

The result of this process is an epitaxial layer that can contain well-defined intermediate surfaces (semiconductor/semiconductor or metal/semiconductor), special doping profiles, or ultrathin layers with electronic quantum states that are dependent on the thickness of the layers.

MBE also produces well-defined surfaces that, under an ultrahigh vacuum, are available for modern surface analysis.

"When I was a student, gallium arsenide was hardly mentioned. Today there are more international conferences on gallium arsenide than on silicon. Gallium arsenide is 10 times as expensive as silicon and probably will be used only in certain highly demanding applications. Gallium arsenide components will be extremely important in the industry."

"Here at Chalmers, we have begun cooperative projects with the industry, including Ericsson Radio Systems. Several institutions are involved in this work," Thorwald Andersson said.

The MBE group at Chalmers now includes four to six people. This group is under pressure from the international microelectronics industry and from the Swedish industry, both of which are seeking personnel with expertise in this area.

The MBE group is involved primarily in producing materials (for industry or research) and with surfaces for surface studies or studies on the formation of

intermediate surfaces. MBE also can be used to produce heterostructures (such as GaAs/GaAlAs) and ultrathin layers as superlattices.

Contact:

Thorwald Andersson
CTH, Fysiska institutionen
412 96 GOTEBORG
Telephone: 031-81 01 00

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MICROELECTRONICS

SWEDISH PROGRAM FOR SENSOR RESEARCH, DEVELOPMENT

Stockholm TEKNIK I TIDEN in Swedish No. 1, 1985 p 11

[Article: "17.5 Million in 3 Years for Sensor Technology"]

[Text] One of the main projects in the National Microelectronics Program (NMP) involves electronic and optical sensor technology.

Over a 3-year period, 17.5 million kronor will be appropriated for research and development in this area.

Sensors are components that convert physical quantities such as temperature, pressure, etc., into electrical signals. After the conversion, these signals may be utilized in various ways.

The development of new sensors is believed to be of great importance, since this work will determine our ability to produce new measuring systems and methods.

From a scientific and technical standpoint, sensors may be divided into the following five groups (all of which are included in the program):

1. Chemical sensors.

This group includes semiconductor sensors that utilize the production technology developed for electronic circuits. By undergoing various types of treatment, the silicon surface may be made sensitive to various stimuli.

Research on these sensors, supported by STU (Board for Technical Development), has been and continues to be conducted primarily at the Linkoping Technological Institute and at Chalmers.

2. Fiber-optical sensors.

These sensors are the result of development work on the technology of communicating by fiber optics. These sensors use some optical quality that is influenced by the quantity being measured.

3. Integrated sensors.

Sensors of this type emit a signal that has no simple relationship with the signal being measured. A useful signal is produced by advanced signal processing in a microprocessor or specially developed electronic circuit.

4. Sensors of group III-V materials.

This group includes semiconductors made by mixing elements from groups III and V of the periodic system, particularly gallium and arsenic. Most of the physical effects utilized in silicon-based sensors are also present in group III-V semiconductors. In suitable combinations, however, the latter are much more effective.

5. Micromechanical sensors.

Major advances in semiconductor production processes have made it possible to utilize semiconductors more and more for mechanical functions. As a result, a new group of sensors has been produced. They are based on the micromechanical properties of semiconductors.

The program for electronic and optical sensor technology includes the period from 1984/1985 to 1988/1989. The program will be evaluated after the first 3 years and, for this reason, no budget figures are available for the last 2 years.

9336
CSO: 3698/444

SCIENTIFIC AND INDUSTRIAL POLICY

PHILIPS' INTERNAL REPORT CRITICIZES JAPAN'S ELECTRONICS TACTICS

Rotterdam NRC HANDELSBLAD in Dutch 8 May 85 Supplement p 1

[Article by Dick Wittenberg: "The False Smile of Japan"]

> [Text] Protection, dumping, theft, and blackmail are part of the strategy with which Japan is setting out to destroy the electronics industry in Europe and the United States. That is the conclusion of an internal Philips study which this newspaper reported on last Monday. According to Philips executive and head of the study group Drs. R. Hamersma, it is still not too late to turn the tide.

It looks like the plot of a cheap science fiction novel: an evil genius who will stop at nothing pursues a clever strategy to take over the world, bright lads attempt to resist the villain.

But we are talking about the content of a cool, businesslike report: an internal Philips study. The picture that arises from figures, facts, and conlcusions is simply that much more threatening because of that: Japan is working to disrupt the world economy. Japan out for world power.

The Philips study ascribes a key role to Miti, the Japanese Ministry of Trade and Industry. Miti, with its 12,000 employees, forms a state within the state, a fortress of strength with practically inexhaustible sources and great powers of persuasion. Companies that do what Miti says can count on generous support. The company that does not go along is punished without mercy.

Japanese industry consists of zaibatsus. Combat groups of companies that tend to destroy one another in their home market unless they can aim at a common enemy. Miti provides them with that enemy: the rest of the world.

In this war against the rest of the world, Miti uses the targeting tactic, also well known as the scorched earth strategy. First Miti selects as the spearhead an advanced product with high added value and low volume. Then all forces are united. Everything--legitimate and illegitimate--is thrown into the struggle to win a decisive advantage. The crowning result of such an operation is that the competition is swept away.

According to the Philips study, Miti has already applied this tactic with great success in the steel industry, in consumer electronics, in numerically-

controlled machines, and in integrated circuits. Business electronics, information technology, the aviation industry, and biotechnology form the new targets.

According to Philips, in the United States Japan used color television as a Trojan Horse to do in the local producers of consumer electronics. A group of companies including Matsushita, Toshiba, and Sanyo--called the "tenth day group" because they got together on the tenth day of each month--decided at the end of the 1960's to bring a color television on the American market for $400. The same thing sold in Japan for $700. The Japanese consumer thus financed the dumping in the United States. The American manufacturers were defeated one after the other.

Conspiracy

For 14 years now a trial has been going on in the United States against the Japanese for allegedly having conspired to force the American competition out of the market. A piquant defense was raised by the Japanese in 1983. They said that the Japanese government had forced them into the price war.

After the color television defeat, the American industry did not even dare try to manufacture video cassette recorders. The Japanese also made that decision very easy for the Americans. Thanks to their profits from color television, they were able to make video cassette recorders available at a rock-bottom price.
In the process they introduced a new method of setting prices. In the past the custom with new products had always been that in the beginning the numbers sold were small and the profit margin large. The Japanese turned the economic laws on their head by making video cassettes available at first for less than cost.

Drs. R. Hamersma, one of the authors of the Philips study and director of corporate planning and marketing support, speaks almost with admiration of the "great VCR game." The Japanese tactic was intended to make it possible for them to produce large quantities as quickly as possible, which would automatically make the cost fall. Yet another advantage was that the competition could only look on from the sideline.

The Japanese speed-up in the second half of the 1970's came at a very bad time for Philips to be sure. The Dutch firm--and note that it invented the video cassette recorder--was unable to match the Japanese products.

When Philips came out years later with the superior V2000 recorder, the world market had already been divided up completely. The Japanese had a market share last year of almost 95 percent.

Deathblow

According tc the Philips study, the Japanese have, thanks to their victory in the video battle, achieved almost a monopoly in the field of consumer

electronics. Taking advantage of this position, they are busy giving the last competitor--Europe--a deathblow. To do so they use three weapons: product standards, market development, and price.

According to Hamersma the Japanese have since become so powerful that they can hold up the establishment of standards for a new product. If Philips wants to have its standard accepted, there is nothing for it but to license it to the Japanese. That happened, for instance, with the compact disk. "Pure necessity," admits Hamersma. "We cannot start anything by ourselves."

Moreover, the Japanese have the opportunity to introduce a new product first on their own protected market. Unhindered by competition, they can in this way quickly achieve large production figures and a low cost. After that they start on other markets with a healthy advantage.

Too, the Japanese enjoy the luxury of being able to dictate prices. According to Hamersma, the Japanese do not make a penny on hi-fi equipment and practically nothing on color televisions. They can permit themselves this because they make good money on their video cassette recorders. The result of course is that the competition is trounced.

Philips notes that new developments in technology no longer appear first in the business sector and in military production. In the last few years consumer electronics has provided the motor driving innovation. That is true of lasers, that is true of sensors.

It is also becoming clear that the demarcation line between consumer electronics and business electronics is becoming more and more vague. Philips' conclusion is: if European industry disappears from the area of consumer electronics, then the basis for innovation is gone. In that case the European manufacturers of business electronics too will be threatened with death.

Digging the Ground Out From Under

In Japan the reverse process is happening. Thanks to their strength in consumer electronics, the Japanese are in an outstanding position to enter the battle with the American producers of business electronics. For this they very consciously do not choose a frontal attack. They prefer to gradually dig the ground out from under the powerful American industry by first aiming at the boundary between consumer elctronics and business electronics: monitors, telephone equipment, copy machines, home and personal computers.

According to Hamersma, the Japanese are using the same tricks by which they earlier forced the American manufacturers of consumer electronics on to their knees. They first provide cheap parts, then high-grade subsystems, and finally the entire machine. The Americans can then only put their brand name on it.

The Japanese are playing the same ace that was so successful with color television: a low price. They are very happy to go without a profit if they can later get it back and more.

"If you once bite, then they have you fast on the line," says Hamersma. "First production disappears, then the technology. You sell your soul and your salvation." More and more American manufacturers are falling into the trap. They have their equipment manufactured in the Far East. Even the IBM personal computer is only one fourth American any more. The result is that the American chip manufacturers are heading for destruction because their market is disappearing. C. van de Klugt, vice president of Philips, warned not long ago in the American magazine Business Week: "You are helping make the bullets that will kill you in the future."

According to Hamersma, it appears from various publications that the Japanese employ yet other weapons. They mess around with patents, they set up joint ventures so that later they can go ahead with the information gained from their partner (fiber optics cable). Nor do they shy away from dumping (cellular radio).

Low Interest Rates

At the same time the Japanese keep their own market carefully protected against business equipment from abroad. American telecommunications systems must first be approved by an institute that is financed by the Japanese electronics companies. High-grade medical systems cannot even enter the country. In a burst of frankness Japanese industry recently stated in an American advertisement: "Sectors with a high value added, high-grade technology, and a great potential for growth receive as much trade protection as can be arranged."

At the same time Japanese firms can count on unconditional support from Japanese banks and government. Hamersma mentions the low interest rates, which are extremely important because many Japanese firms are built on external capital of 80 and 90 percent. He speaks of loans that do not need to be paid back. Of the support provided for innovation by the fact that no value added tax is levied on new products. He also notes the ambitious research projects that are paid for by the government.

The results do not lie. From a Philips note we see that in 1983 the Japanese exported 356 times more consumer electronics products to Europe than did Europe to Japan. To the United States, 350 times more. For electronic parts and business equipment too, the Japanese supremacy over Europe was overwhelming.

America did somewhat better but still had to acknowledge Japan as its superior in both sectors. Since then the gulf between Japan and the United States has gotten even more dramatically bigger. In the third quarter of 1984 America suddenly had a trade deficit of $5 billion in electronics, which was almost all in telecommunications equipment and integrated circuits.

Star Wars

The conclusion of the Philips study: free trade and the free market are at risk. According to Drs. Hamersma, there are moreover indications that European and American defense will grow more and more dependent on Japanese

technology. "An enormous danger," says the high Philips executive. He says that President Reagan's Star Wars program only makes sense if the research looks not only at the rockets but also at the resources needed to produce such projectiles, such as fifth generation computers.

Philips starts from the idea that world free trade must be restored again. That means: no more protectionism, no more trade barriers. That also means: company against company, not Philips against Japan.

Until we get to that point, the Dutch multinational wants to strengthen its position outside Europe. "In order to be less vulnerable," Hamersma explains. Too, Philips will continue to work for strategic cooperation agreements and for unification of the European market. Further, the company aims for aggressive innovation and marketing.

At the same time the European Community too must do something about Japan's passion for domination, Philips thinks. The concern has proposed that European producers of consumer electronics be given a market share of 60 percent for all vital products such as video cassette recorders and compact disk players.

To this Philips adds the further limitation that only those articles be counted as European products that are at least 60 percent made in Europe. The Japanese assembly companies that have been set up here and there are thus not included, unless from now on they purchase more parts in Europe.

Philips believes that as a temporary measure the import duty on Japanese hi fi equipment and video cassette recorders should be raised from 8 to 14 percent. The breathing space that created could be used by European industry for an ambitious restructuring. Here Philips is thinking in terms of reducing the number of factories, greater automation, and longer working hours.

Further, the European Community should as a permanent policy determine that young, high-grade European industries have a right to protection through an import levy of 19 percent. Further, Philips wants a speed up in standardization and a more flexible attitude towards industrial cooperation for stategic renewal.

According to Drs. Hamersma, the Dutch government is still studying the Philips proposals. The government should, he says, present the action plan to the European Community.

The import levy of 19 percent on Japanese compact disk players proves, Hamersma says, that measures do help greatly. Thanks to this trade hindrance Philips has been able to develop into one of the largest producers in the world. The seven Japanese manufacturers say that this year they will produce around two million players. Philips counters with a production of 1.2 million pieces. According to Hamersma, the firm can boast not only of a substantial market share in Europe but also in the United States and even in Japan. Philips has learned from the Japanese VCR game. In the case of the compact disk player, Philips accepted heavy start-up losses just in order to reach high figures quickly. Despite this, Philips expects to shoot past the break-even point already this year with the compact disk player.

"As a citizen of Europe I am uneasy about the threat coming from the Japanese," says Hamersma. "As a Philips employee I think that there are definitely good possibilities of turning the tide."

12593
CSO: 3698/455

SCIENTIFIC AND INDUSTRIAL POLICY

FRG VENTURE CAPITAL COMPANIES UNWILLING TO TAKE RISKS

Duesseldorf WIRTSCHAFTSWOCHE in German 8 Mar 85 pp 66,68,69,71

[Article: "Venture Capital Companies. No-Risk Ventures"]

[Text] The approximately 30 private venture capital companies which now exist in the FRG have capital available for investment amounting to DM 700 million. And yet small companies in particular are having difficulty financing high-tech projects in the venture capital market.

It was hopeless. In resignation, Gerd Blanke, age 37, degree in physics, broke off his discussions with about five banks concerning additional financing--despite a business plan, despite an analysis by renowned business consultants Frost & Sullivan of the rapidly expanding U.S. market and despite private holdings in the project. "At a certain stage in the negotiations we always ended up in the same situation: The other side said that the American market studies may be accurate but they cannot estimate the overall chances for the product on the European market."

In the meantime approximately three years have gone by. The product debated back then--a computer capable of displaying graphics through the use of suitable software programs and peripherals--is now also enjoying sales in this country with a double-digit growth rate. Other companies, however, have the lion's share of the business graphics market--mostly subsidiaries of American firms. For Blanke this was clearly a missed opportunity. "Naturally we are upset that our only stumbling block at the time was financing," he recalls, "but we were simply unable to provide the assurances of a client model."

Today such things are no longer supposed to happen. There are now about 30 venture capital companies in the FRG with about DM 700 million in capital waiting to be invested. Bankers from Flensburg to Constance know the importance and potential of innovative high-tech firms--lucrative projects can simply no longer fail for lack of financing. And yet: Has it really become much easier for small firms to obtain venture capital? "Actually no," complains Dieter Kreft of Angewandte Digitalelektronik (ADE) in Brunstorf near Hamburg, "there is just an awful lot of talk going on."

His 50-man company has a novel, contactless distance-measuring device called Pomux (for positioning multiplexer) ready for series production, the development of which was funded under the special microelectronics program of the

Federal Ministry for Research and Technology (BMFT). Sales potential on the domestic market is thought to be excellent; the first customer right away ordered 50 of the devices. For an innovator like Kreft it was therefore immediately clear that this unrivaled piece of German high-technology ought to be offered on the American market--obviously an ideal target for venture capital financing.

In practice, however, there is still a catch. "Providers of capital are not in a position to evaluate the technical quality and value of a product," sums up Kreft. Worse yet, they obviously do not even try to do so. "They didn't even come to trade fairs to which we had invited them," said Kreft. The negotiating parties touted their "fabulous ties" to California, but they were only bank ties--of little help when one is seeking suitable distributors or contractual partners, e.g. venture management people, in an initially foreign market.

Achim Mueller, a 45-year old degreed engineer, also knows about less than productive negotiations with private venture capital companies. "They would prefer to finance a production effort only on the basis of customer orders," he says. They expect, he adds, "a fully marketable product"; as soon as the negotiations bring out that money must be spent to a greater or lesser degree on development to make it marketable, "they wave good-bye."

Together with a partner, 44-year old degreed engineered Hans-Joachim Wendt, Mueller has been trying, unsuccessfully up to now, to finance through the venture capital market the production of an internal combustion engine with no rods or crankshaft--a novel invention for which German, European and U.S. patents have already been obtained.

In contrast to a classical internal combustion engine in which the control equipment and power-output section are mechanically coupled to one another and the movement of the pistons and the crankshaft controls valves and fuel injection, the engine invented by Wendt has microelectronic controls which are separate from the crankshaft. This control separation provides a greater degree of freedom--piston displacement, compression ratio, and top and bottom dead center, for example, are variable. The advantage from a technical standpoint is that with suitable programming, optimum control can be achieved at any given load. Wendt and Mueller have set themselves very modest company goals. They want first to penetrate a small market segment which includes stationary powerplants with outputs of up to 30 kW, which should be possible within three years according to their plans.

About DM 3 million will be required in order to market and begin production of the operational prototype which was developed under the special microelectronics program of the BMFT at a cost of over half a million marks to date. Up to now, however, the venture capital scene has been illusive; from BIH-Innovations- und Handelsgesellschaft mbH to Genes Gruendungsberatung und Managementservice GmbH to Venture Capital AG, 10 venture capital companies have been approached--all to no avail. "We have not given closer consideration to the internal combustion engine without crankshaft because our criteria were not met," explains venture capitalist Thomas Kuehr, 38, of Genes, which acts as the consulting company for International Venture Capital Partner AG (IVCP) located in Luxembourg. In its caution the IVCP does not engage in seed financing at all.

When it gets right down to it, the risks cannot be small enough; as always a "balance sheet for the past three years a la Schimmelpfeng" is required and for security "the fourth mortgage on your own home yet, too," says Mueller. Newly founded companies, also called startups, whose initiators already had to go into debt to produce a prototype have no chance any more. Immediate result: Experienced engineers, who like Wendt and Mueller have been in management in larger firms for years, will not even get close to projects which require large amounts of capital.

Moreover, there is a characteristic contradiction in the thinking of venture capitalists which continues to anger technically oriented company founders: a degree of indebtedness is expected of them in the personal and private sector which would immediately discredit the parties involved in their capacity as company managers. "Somehow that is a bit ridiculous," says Mueller who has encountered this dual morality again and again during negotiations. It is probably more the reinsurance mentality of venture capitalists than an actual lack of projects worthy of financing which, in view of the capital surplus in this sector of about DM 700 million, leads to complaints of a lack of investment opportunities--as WFG's chief executive officer Karl-Heinz Fanselow mentions on occasion. For Hans Pottenkolber of Munich, with his Holo-System GmbH a pioneer in the field of holographic measurement technology for more than 15 years, this is "very nearly a provocation," which, "indicates a great deal of misinformation about German technology." In the field of venture capital there are "many companies following the trend," says Rottenkolber, "but I don't see any indication of a private venture capital market." The numerous venture capital companies founded recently, he says, are just window dressing, "like going to church on Sunday."

Munich's laser optics producer Rottenkolber feels the absence of the competent direct investor able to recognize how ideas, action, experience and a bit of luck act "like a spiral galaxy" to taken on the form of a potentially successful entrepreneur. Rottenkolber knows what he is talking about: Ernst Hutzenlaub, now deceased, who had already co-financed the development of the Wankel engine, took the "risk" of investing in Rottenkolber's Holo-System GmbH.

If entrepreneurs in the field of hardware have a difficult time explaining their business making clear to their negotiating partners in the world of finance, the software producers, who must deal at the outset with the "SM-Software- und -Tewidata Syndrome", really have a problem. We have spent hours and hours on paperwork trying to explain to technically incompetent people what we are trying to do," complains Klaus Schleisigk, 34, of System-Partner GmbH of Hamburg, "and no one is paid for their time." This firm, which was founded four years ago and now has four employees, produces turnkey systems involving personal computers for industrial applications and must now be content with slower but self-financed growth. Public funds are avoided by Schleisigk like "the devil avoids holy water"--an attitude shared by many of his colleagues in the same business.

Gerd Blanke of Microtaurus Software-, Entwicklungs- und Vertriebsgesellschaft mbH of Berlin says that, "Again and again we have to deal initially with the same agencies: the Berlin Senate, the VDI (Association of German Engineers)

Technology Center, the Berlin Industriebank. Providers of private venture capital then hide behind these agencies according to the motto 'well, if the Senate cannot give you anything ...'"

Microtaurus produces transportable software for process automation which can be run cost-effectively by microprocessors. Six months ago the company, headed by 34-year old mathematician Sabine Kamprowski, negotiated with Techno Venture Management Gesellschaft (TVM) for financing to aid development engineers in programming this single-board computer in the Forth language. Including the generation of final documentation about DM 250,000 to 300,000 was required for this project for which the company would have had to hire extra employees--for a small four-man operation using their own resources they would be a long time in realizing their goal. But the negotiations with the managers of TVM produced "absolutely nothing." They were in no position to evaluate the software product and depended instead on academic experts at the advanced schools--where, according to Blanke, the "high priests of Pascal" are ensconced who have not yet heard of the advantages of programming in Forth for measurement and control technology.

What happened to Gerd Blanke with business graphics could also happen to Kurt Beer, 37, chief executive officer of Rainbow Gesellschaft fuer innovative Technologie mbH. He went to TVM with a project for a mobile, intelligent robot for the security services sector, a market which according to a study in the U.S. by Future Computing, Inc. predicts sales of $2.3 billion in 1990. But after "in-depth discussions" TVM came to the conclusion that the project would not be pursued "right now." "If new information is forthcoming, we will get back to you," was their position. What angered Beer was that the "in-depth discussion" in any case did not include him and that the decision was actually made at someone's desk on a standard refusal form. "A project cannot be evaluated solely on the basis of what exists on paper, without personal discussion," said Beer.

As a businessman himself he is well able to empathize with the difficulty that engineers and technicians have in preparing clearly defined business concepts. "If they are not even given the opportunity to present their ideas in person, they really have no chance," he said. For Beer's Rainbow it is a matter of finding a "lead investor" to supply half of his capital requirements of about DM 3 million--the firm's bank and private investors are willing to supply the other half. In February 1984, Venture Capital AG, also involved in the project, asked him to be patient a little longer due to the large number of requests. Beer has been doing that for a year now.

Where in-house technical expertise is lacking, venture capital financing becomes a classic kind of administrator of money and investments much like a bank. "Old wine in new bottles," describes the venture capital business in the opinion of Guenter Koch of Biomatik in Freiburg, a company founded in 1982 which develops software for medical computers and production control systems and which has increased its annual sales to significantly more than half a million marks with six permanent employees.

Result: The money is available but the hurdles placed in front of it are relatively high. The venture capital companies are under pressure to prove that their business is flourishing. Therefore, it is often the case that no real risks are taken.

For many high-tech companies it is a sobering experience when, following their efforts toward realizing the idea for a product, the negotiations for additional financing of the venture often turn into a long and tiring kind of ping-pong debate of the risks involved. Not every provision of venture capital in the FRG corresponds to the ideal, typical venture fund which covers its costs and makes a profit solely from the increased value of the firms involved and not from premiums for taking in and disseminating capital.

Klaus P. Friebe, head of the VDI Technology Center in Berlin, also fears that the business of venture capital financing is "still beset with too many illusions," that while money is available and companies have been founded, at the same time the potential for consultation and professional support to the entrepreneurs has not kept pace. "If you want raisins in your cake, someone has to grow raisins."

12552
CSO: 3698/366

SCIENTIFIC AND INDUSTRIAL POLICY

FRG REGION BROKERS VENTURE CAPITAL FOR HIGH TECH PROJECTS

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German
3 May 85 p 4

[Article by Graduate Engineer Rolf Schiller: "Capital Procurement for New Technologies is Tough Going--A Field Report by the Innovation Consultancy Service of the Lake Constance-Upper Swabia Chamber of Commerce"]

[Text] A brokering attempt by the Innovation Consultancy Service of the Lake Constance-Upper Swabia IHK [Chamber of Industry and Commerce] between venture-capital companies, direct-investment firms, and technologically oriented company founders shows that the teething troubles of venture financing are far from having been overcome.

What is to be done when we are sitting on a pile of unmined technology which cannot be worked because the money is lacking, and when politicians prefer to lay down their rail lines in man-made landscapes--in other words: Technology centers? Ostensibly, money for technology is not supposed to be scarce: The venture-financing companies which have opened up within roughly the last 2 years are said to already have a combined sum of almost DM 3/4 billion, quite aside from what could be brokered privately through banks within the framework still of genuine private enterprise.

Why then are we complaining about a lack of jobs, and on the other hand are not getting down to business in a very proper way on promoting new technologies which could create such jobs? As an innovation consultant, one becomes acquainted with the pitfalls involved when one tries to get market-ready projects moving which are promising but capital-intensive. That is, many well-intended government financing opportunities misfire because for the most part they are designed from the viewpoint of individual departments and because they let the founders of innovative companies fall through the "interdisciplinary cracks."

It makes sense at the present time to provide a lender brokering between equity capital and new products and processes. This can be done very easily by way of the innovation consultancy services connected with the chambers of industry and commerce, which in the FRG furnish an almost all-encompassing infrastructure for this purpose. A strict borrower brokering--experience shows--is not enough.

The Innovation Consultancy Service of the Lake Constance-Upper Swabia IHK, Weingarten, teamed up with the neighboring chambers of Augsburg and Ulm to undertake a brokerage program. In addition to the brokering of venture-capital firms and trade-investment firms, their goal was also to bring in the banks for the purpose of establishing contact with private parties and improving the publicity work for the projects. Thus, on 1 February 1985 at the Ulm IHK, 13 projects chosen by the innovation consultants were presented to 5 venture-capital firms and a large number of banking experts and journalists. Ten of these were already at a stage of development where an investment by venture-capital firms was presumably possible.

The presented projects included, for example:

- A process for reducing the bitterness of lupines (lupines grow even in barren soils, are soil improvers, and can be important sources of food for the Third World);

- a self-contained etching process for printed circuit boards which does not generate waste water;

- a household garbage recycling process with a very high degree of byproduct recovery which pays its way due to the savings in garbage disposal;

- a process for manufacturing ethanol from biomass (reutilization of agricultural areas, suited also to developing countries--renewable sources of energy);

- a geometric mode for videotex.

In order to avoid difficulties in communication between lenders and engineers, the technicians presenting the projects were given a short list referring to noteworthy points such as the presentation of the overall enterprise concept, the managers needed, the capital requirements, the predicted profitability, the market conditions, and chances for growth.

What experiences are now at hand? Is such a brokering successful, and what is worth improving? Ominous facts became apparent to the organizers of the event even before it began: Of 18 selected venture-capital companies (those which are only regionally active or are lenders only for quite specialized industrial branches or do not lend to founders of innovative companies were not considered), about 2/3 supposedly never received the mailed invitation. After a great deal of effort over the telephone, eight firms were left which showed an interest, of which again one dropped out because supposedly it was already familiar with 80 percent of the projects. But subsequent inquiries concerning this assertion by one company (which recently has proclaimed again and again through its representatives that there is no shortage of venture capital and that no projects are out there) demonstrated that only 20 percent were known to it! Thereupon five venture financiers showed up. In contrast to this, the commitment of the banks was considerably more spontaneous. Shortly before it started, the entire event was on the point of overflowing beyond the confines of its premises,

because interested parties from the nearby area above all were crowding in. The commitment of Land authorities responsible for business promotion was also no problem, nor was the appearance of newspapers representing the region.

In connection with the 11 projects ready for brokering, the following picture emerges 7 weeks after this event: Three venture-capital firms are presumably active in connection with two or three projects. All the other projects are either still just simmering or are to be carried on by means of private equity money. But at least in some cases there is a shortage of financiers for these. Unfortunately the banks continue to be cautious in suggesting financing opportunities, because they fear that developments could turn out badly.

In view of the high quality of the preselected projects, the capital participation quota could turn out to be higher. Viewed in this way, was the brokerage action thus a fiasco? No, even though nothing can be said yet about the possible results: All the presenters of projects were glad to have the opportunity to gain experience in such a concentrated form with venture companies. They have learned something from their experience--even if what they learned was not always immediately utilizable.

Many had the impression that no true venture can be entered into with these companies and that it was too early for them to get aboard. This is surprising, because many projects are so far advanced that they virtually no longer entail any technical risk, with it ultimately being merely a question of production and the opening up of markets. But all venture financiers compete with each other for deals at this stage of an innovation project at the latest.

Quotes from this event: "Venture-capital companies are behaving like government project executors, but they are much more fearful, since they do not have any experience and are expected to take risks." "To be asked to itemize 52 parameters for the next 5 years is a tall order."

How did the representatives of venture capital react? Some of them preferred to withdraw before the end of the event, and soon there remained only those companies which at the outset had already shown that they had received their mailed invitation in due order and had promptly accepted this invitation. From their point of view, the following problems arise: If they write to the project executors, they run the risk of arousing expectations which cannot be fulfilled. Projects may in fact be attractive, but may not yet have reached the point where something can be undertaken. One participant even viewed the limited amount of his possible financial interest as a troublesome factor. Another: "It is a very good thing when the IHK provides such coordination. We have a general problem in Germany: Founders of innovation companies do not entirely appreciate the significance of such a presentation. Compared to America, our financiers are provided with far too few basic economic data. Many projects are getting shelved which should have been decided on already wherever possible." The next comment in writing: "...I want to inform you that in four cases I have declared my interest in a cooperative effort.

"In one case, this pertains to a participant at the event whose project was not presented. Whether the talks we initiated will lead to a positive conclusion is not yet foreseeable, of course. It would be a welcome thing to me if you were to organize this venture-capital market annually and if this became a model for other regions. However, a more strict selection could not hurt. This applies both to the quality of the presentations and also to the seriousness of any expressed readiness to obtain capital."

In fact, one firm had "gate-crashed" in order to have better chances for inclusion in the announced technology center! The opinion of another financier: "We are not a typical venture-capital company, but we would like to keep in touch with these so as to be able to become involved in trade investments. The idea for the event was excellent, and we are in contact with two firms. A shift in emphasis more toward the bases for costing in the presentations will arouse greater interest."

At the present time the following general conclusions emerge in connection with relations between technicians and financiers:

- Company founders prefer private capital over financing by venture-capital companies. The reason for this is not only that they expect less expensive financing from the former, but above all because the latter companies are felt to be impersonal, and the firm founder does not know who all may be looking over his shoulder.

- The necessity for drawing up more detailed written plans is not yet understood by many engineers.

- A large number of engineers still lack an eye for the essentials of financing or for marketing methods.

- In order to preserve their independence for as long as possible, some of those involved tend to approach development more slowly and with fewer resources. In doing so they fail to perceive that they themselves may be left behind by developments and that a bargaining position with their backs to the wall no longer allows the necessary mobility later.

- A large number of venture-capital companies are evidently preoccupied too much with internal matters. Surely it can already be expected that within a few years the number of these firms will have declined again.

- In view of the business situation of the lending venture-capital firms, contacts must be made as early as possible.

- It seems open to question whether venture-capital companies really want to take risks.

- The capital raisers should assuage the fear about co-management. This can be done best through giving specific details on the nature of the joint activity.

- Private financiers and venture-capital lenders should make active use of the innovation consultancy services as capital brokers.

- Venture-capital lenders should avoid giving the impression of a concern for bureaucratic practices, and for the purposes of making preliminary decisions they should request a project description (on the basis of a rough outline) rather than answers to a multitude of detailed points.

In short: At present difficulties are still being encountered, even with the use of private backers, in closing the financing gap following the stage of technical realization and before the stage of market introduction which the State has left open--and properly so! This is due to the nature of risk-taking and the difficulty of the subject under consideration and of prediction.

12114
CSO: 3698/466

SCIENTIFIC AND INDUSTRIAL POLICY

BASF OF FRG INCREASES R&D EXPENDITURES

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 29 May 85 p 17

[Text] BASF AG, Ludwigshafen--The BASF group is increasing its research expenditures to DM 1.5 billion in the current year (following DM 1.24 billion last year). In 1985 it will be spending about DM 3.8 billion for research and investments in physical assets, about a half a billion more than last year.

To this chemical concern, special efforts are called for in new innovative fields of activity such as biotechnology, high-performance composite materials, and new systems in information engineering. In broad outlines, the BASF distinguishes three emphases for its research work. One of these has to do with highly improved products for growing markets, such as agrochemicals, drugs, vitamins, or information systems. On the other hand, major lines of special-purpose products whose manufacturing presupposes a specific knowledge are also being developed. A third field is the development of better and more economical manufacturing processes for the major key products of the company. The BASF mentions as an example of this a new production method for adipic acid, an important initial product for fibers and plastics. This method starts with simple constituents which are available in sufficient quantities.

A new line of products is being offered for the purpose of decreasing the percentage of phosphate in nonpolluting detergents. BASF is obtaining materials with interesting new properties by way of fusing various types of polymers. For example, polymers have been developed which are electrically conductive in a manner similar to metals. An initial result has been the preparation together with Varta Batterie AG of positive battery electrodes which in many cases are rechargeable.

In fiscal year 1984, BASF spent DM 1.24 billion (following DM 1.19 billion the previous year) for its research work. In addition, DM 138 million were invested in research institutions and experimental facilities. Some 633 patents were filed at the Patent Office, for a patent inventory of 5,800 applications domestically and 29,000 applications in foreign countries. The net royalty income for this group was again positive: Contrasting with DM 76 million worth of royalties received, license costs were DM 64 million.

12114
CSO: 3698/466

FRANCE DEVELOPS 1986-88 PLAN FOR HIGH TECH R&D

Paris AFP SCIENCES in French 7 Mar 85 pp 1-4

[Unsigned article]

[Text] Paris--The formulation of a three-year plan for research and technologic development, covering the 1986-88 period, was accepted on 6 March by the Council of Ministers, following a speech on this topic by Hubert Curien, minister of research and technology.

This plan, as indicated by the press release published after the council meeting, "should place France among the leaders of the large industrialized nations in the area of research."

The draft bill for this plan will be submitted to Parliament at the next spring session. This three-year plan will follow the Orientation and Planning Law for Research and Technology (LOP), which was adopted by Parliament in July 1982, and which terminates at the end of this year.

The speech on research was the only one presented to the Council of Ministers on that day, an action which Georgina Dufoix, government spokeswoman, indicated is most "unusual," adding that it was carried out quite intentionally "to show the importance which the government assigned to this matter."

The Prime Minister categorized Curien's speech as "decisive," and at the end of the Council meeting, Mr Curien himself stated to the news media that for the President and the Prime Minister "research and technologic development are a strong priority for the country," and even, he added, "of the highest priority."

As indicated in the press release, the six major orientations for the future plan are the following:

1. Develop research in industrial environments, particularly in the conventional industry sectors, where the effort made in this respect is still weak.

2. Increase the share of enterprises in the national research effort, notably through simple fiscal incentive measures open primarily to small and medium-sized enterprises (PME). The research tax credit procedure will thus be strengthened and expanded.

3. Conduct a long term scientific and technical training and employment policy, to supply agencies and enterprises with a sufficient number and quality of researchers and engineers, and to guarantee regular recruitment.

4. Increase laboratory operating facilities and equipment, notably in computers and large instruments.

5. Pursue large technologic development programs to bolster the positions established by our country, and achieve the ambitious objectives that it has chosen in areas of the future (space, aeronautics, energy, oceanography).

6. Further improve the efficiency of the national research spending. In this spirit, emphasis will be placed on the evaluation of research activities, with indicators which will make it possible to assess the results of implemented policies.

In regard to these different points, which he essentially reclassified into four "major targets" (long term scientific and technical employment policy, upgrading of laboratory operating facilities and equipment, modernization of the industrial sector, and major technologic development problems--PDT), Mr Curien made the following comments:

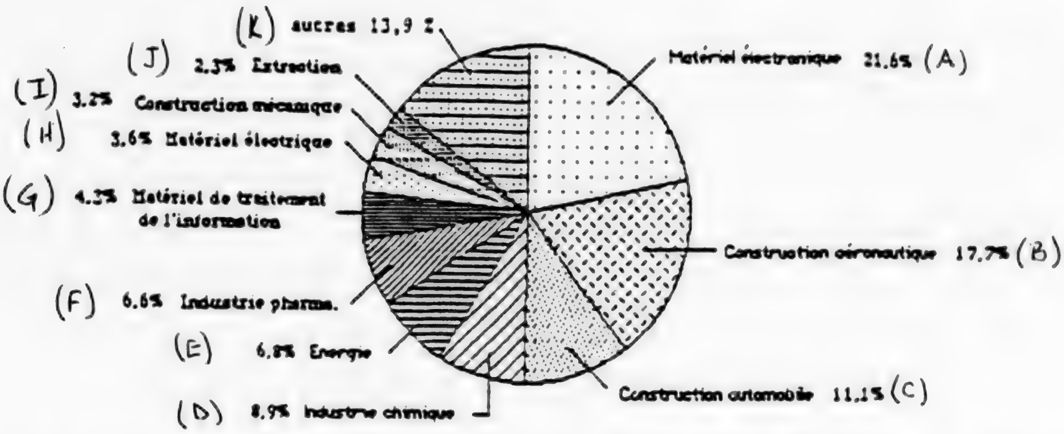
1. For R/D development in industrial environments "we are still weak, since it assumes only 43-44 percent of the national R/D spending, while in other countries, such as FRG, this figure is 56 percent."

However, the average annual civilian R/D budget growth (BCRD) between 1981 and 1985 has exceeded by more than 7.5 points the PIB (gross domestic product) growth rate, and the share of national R/D spending in the PIB has thus gone from 1.85 percent in 1980, to 2.25 percent in 1985.

This priority, assigned by the government as part of the budget, as well as the effort of the national enterprises, has led to an average overall volume increase of 5 percent per year in the financing of enterprises from their own funds during this period.

The national enterprises (with +5.6 percent per year in volume) played a "leading role." The effort of the private sector increased only by +2.5 percent per year.

For Mr Curien, "France has thus begun to reestablish its position with respect to its major foreign partners and competitors, even though the latter have increased their effort considerably during the same time. Domestic R/D spending for the 1981-1983 period was greater in France (+1.9 percent) or in the United States (+4.7 percent), but remains lower than Japan's (+8.9 percent).



R/D in enterprises in 1983. Distribution of domestic spending by branches.

Key: (A) Electronic equipment, 21.6%
(B) Aeronautics construction, 17.7%
(C) Automobile construction, 11.1%
(D) Chemical industry, 8.9%
(E) Energy, 6.°%
(F) Pharmaceutical industry, 6.6%
(G) Data processing equipment, 4.3%
(H) Electrical equipment, 3.6%
(I) Mechanical construction, 3.2%
(J) Extraction, 2.3%
(K) Other, 13.9%

Mr Curien also pointed out that "a particular effort will be have to be made in the conventional industry sectors, such as textiles, agricultural food products, and so on."

2. This fiscal incentive area has already been allocated 300-400 million francs for 1500 enterprises, of which about 60 percent are PME. Moreover, the procedures implemented to attract savings to research investment are beginning to bear fruit: even though their fiscal status is still not sufficiently attractive, mutual venture capital investment funds (FCPR) had raised 19[illegible] million francs by the end of 1983. The number of financial companies devoted to innovation doubled during the period under consideration.

Other measures are under study. Mr Curien pointed out that in November 1983, ten measures to encourage industrial research were announced, and since that time have led to significant results, such as the doubling of CIFRE conventions in one year, the progress of efforts to encourage research in engineering schools, the large increase in the share of the Research and Technology Fund devoted to industrial research (which went from 35 percent in 1983 to 48 percent in 1984, and which will amount to 50-55 percent in 1985), and so on.

Also launched were four multi-annual programs for technical research, joining industrial manufacturers, technical centers, and public research on sensitive topics. New programs will be launched in 1985.

3. For scientific employment, Mr Curien added, we must avoid "untuned accordion motions," and adopt a steady hiring rate. Since 1982, research personnel has increased at an average annual rate of 3.3 percent.

4. Laboratory endowment of semi-heavy equipment, such as good computers and good spectrometers, whose price falls between 1 and 3 million francs, will be encouraged, and directives in this respect have been issued by the minister of research to the directors of large agencies.

5. Large technologic development programs, all antedating LOP, grew an average of +3.6 percent in volume during the past three years. "France has reached some good positions. We must continue, increase, and develop international cooperation," indicated Mr Curien.

6. The quality and value of research will have to be assured by "constant evaluations of what is being done, and by making the right choices," indicated the minister.

In conclusion, Mr Curien wanted to stress that in all this, "social and human sciences will of course not be forgotten. Without them, it is not possible to have a policy of progress and modernization."

The formulation of the the law instituting the three-year plan will require "an extensive cooperation with social and economic partners, research agencies, and regional groups." A commission of about thirty members will be established.

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FRENCH RESEARCH MINISTER ON EUREKA PROJECT

Defends Ambitious Projects'

PM121351 Paris LE QUOTIDIEN DE PARIS in French 5 Jun 85 pp 3-5

[Interview with French Research Minister Hubert Curien by Pascal Richard and Christian Gerin; date, place not given]

[Excerpt] LE QUOTIDIEN: What stage has been reached with the Eureka project? What is its timetable?

Hubert Curien: We were keen to approach our partners with an open agenda so that it can be a truly European project. The further I proceed with my deliberations and contacts the more I realize that Eureka will really take off when European industrialists take an interest in it. I am pleased to be able to tell you that at a dinner to present Eureka to the managing directors of France's major enterprises, I encountered a very direct interest on their part. This interest will that much greater once the objects or systems to which they will be invited to contribute have been clearly defined. It is necessary to define ambitious objects and systems -- this is the idea behind Eureka -- to drive European technology forward by means of ambitious projects. The example of Hermes (the European space shuttle -- LE QUOTIDIEN editor's note) is clear: It will act as a driving force behind European technology. Another example is mastery of microelectronics, which will permit the creation of high-performance weapons, computers, new-generation rockets, and flexible workshop robotics. Within 10-15 years Eureka should produce some very advanced know-how for our industries.

LE QUOTIDIEN: Will France be in the vanguard of this program?

Hubert Curien: A project does not really advance unless it is led with determination, which is why there must be a boss at the head of an enterprise. Eureka combines a number of topics -- data processing, communications, space, and so forth. There will be a leader in charge of each variable geometry project. That does not mean that Eureka must become a bone of contention among the European countries. France, like all the four major European countries, has the means to act as a driving force.

LE QUOTIDIEN: In which specific field could France act as leader?

Hubert Curien: Space, of course. I also have in mind a very advanced data processing project -- a major computer -- and an advanced telecommunications project.

LE QUOTIDIEN: Will France's participation in Eureka be financed from the research budget?

Hubert Curien: The state could provide money but the project will not be financed solely by state subsidies. Eureka is principally the concern of businessmen. State intervention will be limited.

Emphasizes 'Civilian' Uses

DW130545 Frankfurt/Main FRANKFURTER RUNDSCHAU in German 12 Jun 85 p 2

[Interview with Minister of Research and Technology Hurbert Curien by correspondent Hans-Hagen Bremer in Paris; date not given]

[Text] [Bremer] Mr Minister, there is an impression that the Eureka project is a tactical improvisation rather than a long-term strategy. Is that a wrong impression?

[Curien] Eureka is neither improvised nor tactical. It is a coincidence that it was made public at the same time the U.S. Secretary of Defense was asking the Europeans to decide on cooperation in the SDI program within a 60-day period. SDI induced us to submit our proposals more rapidly.

[Bremer] What is Eureka supposed to be?

[Curien] We want all European countries to hold their positions among the technologically leading countries. If we do not make this leap forward, our industry will run the serious risk of systematically becoming a contractor for the United States and possibly even for Japan, and thus it will be in danger of losing its competitiveness.

[Bremer] The areas of research of SDI and Eureka are largely identical. Is that a coincidence?

[Curien] It may look as if this were the case. SDI is largely concerned with modern technology but, on the other hand, it has not been specifically defined by individual projects. The fact that certain areas overlap with Eureka is nothing unusual. We intend to set up our projects in line with our interests. For example, boitechnology is not taken into account in SDI.

[Bremer] SDI will be a military research program, and Eureka a civilian one. Will the results be equally utilized for civilian as well as military purposes?

[Curien] Many European countries do not like the idea of mobilizing industry for military purposes. Therefore, European cooperation must first of all cover civilian areas, particularly if we want to win over countries like Austria, Switzerland, or Sweden. Progress in the field of data processing [informatik] is decisive for civilian as well as military programs because the same integrated circuits and computers are utilized. However, Eureka was conceived on the basis of its incended civilian use.

[Bremer] Are there any concrete projects yet that could be decided on at the next EC summit?

[Curien] Agreements are possible in the fields of data processing, communications, and biotechnology. This could be brought up by the heads of governments when they meet in Milano in late June.

[Bremer] How about other work fields such as optronics, high-speed computers, micro-data-processing, lasers, and new materials?

[Curien] In this respect, the governments and interested enterprises will have to continue to define projects. However, I think we will soon have about 10 programs.

[Bremer] Do you have any idea of the costs and financing?

[Curien] First of all, we must define the programs. Then the costs can be estimated. It will not be possible to finance them without further efforts. However, this does not constitute a revolution in the research budgets.

CSO: 3698/493

HIGH TECHNOLOGY COOPERATION WITH FRANCE DISCUSSED

AU241410 Vienna DIE PRESSE in German 24 May 85 p 2

[Reinhold Smonig report]

[Excerpts] Paris--Negotiations on specific industrial cooperation projects, especially in the high technology sector, next to general economic talks were the central issues on the agenda of Transport Minister Lacina's visit to France, which ended on Thursday [23 May]. The minister, who is also in charge of nationalized industries, headed a large economic delegation which included Karl Kehrer, secretary general of the Austrian Chamber of Commerce, and leading representatives of nationalized and private Austrian companies.

In the high technology sector, to which Lacina is paying particular attention, the greatest progress to date has been made in negotiations on cooperation projects between Austrian and French companies in the fields of microelectronics, biotechnology and new materials.

The microelectronics sector, a cooperation project between the French Thomson electronic concern and the Austrian Schrack Company is being negotiated. Further pending cooperation projects involve the French Rhone-Poulenc Chemical concern and the Chemie Linz Corporation as well as the Donau-Chemie Company, which is partly owned by Rhone-Poulenc, and a large joint project is planned by the French Pechiney Aluminum concern and the Austria Metal Corporation in Ranshofen.

In his official talks, among others with Industry and Foreign Trade Minister Edith Gresson, Minister Lacina sought French support for Austrian political wishes. According to Lacina, the French side reacted very positively to the Austrian wish for participation in European research programs such as the "esprit" information technology program, and it also promised state support for Austrian-French joint ventures in third markets.

CSO: 3698/491

FLEMISH HIGH TECHNOLOGY STRATEGY CRITICIZED

Brussels KAPITAAL & BUSINESS in Dutch Spring 85 pp 69-73

[Article: "Employment Zones, The Great Illusion?"]

[Text] The president of the Flemish executive [council], Mr Gaston Geens, declared during the last meeting of Flanders Technology International that "the initiative has to come from the SMC's [small and medium-sized companies]." Here, initiative simply refers to a blossoming of Flanders through innovation and creativity. Yet, each SMC will allege that it is willing to take the initiative... provided some important conditions have been fulfilled.

Innovation and creativity do not come of their own accord. They are only possible if there is sufficient fiscal and social breathing space available. This implies for Minister Geens that the ball is now in the national government's court, and it will have to show a certain degree of creativity itself. And this inevitably brings us to the T-zones [employment zones]. What about them? Royal decree number 118, published in the STAATSBLAD [the official gazette] the day after Innocents Day [28 December] in 1982, has now been in effect for over 2 years. This decree stipulated that companies which went through the selection procedures are obliged to start in this zone during the 3 years that followed the public announcement.

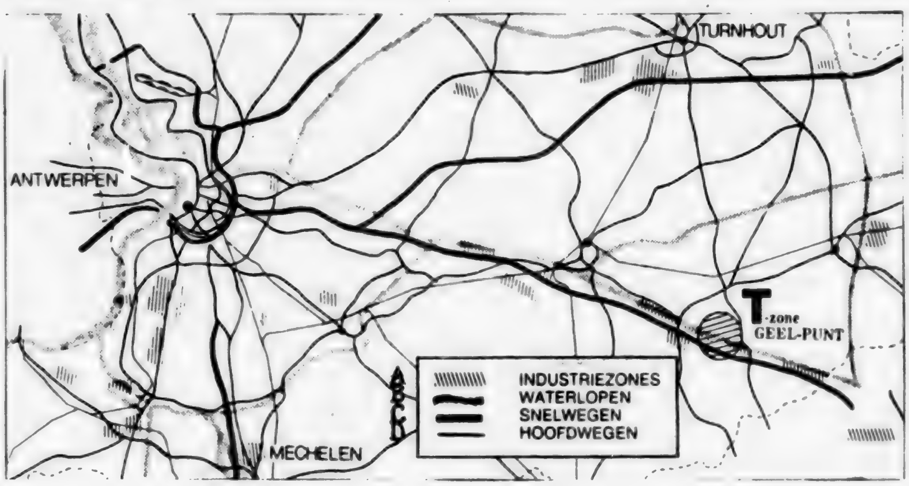
Poor Results

Thus companies still interested in applying must hurry. They have less than a year left.

The question is, however, whether a big rush [of applications] is still to be expected. So far only 13 companies have shown interest in the T-zones! Their locations are as follows: one in Liege, one in Fleurus, one in Ieper, two in Diest, two in Tessenderlo and six in Geel.

Thus apparently the Walloon [French-speaking] part of Belgium is not very popular with future T-zone companies. Or is this simply because the Flemish government conducted a somewhat more dynamic publicity campaign? If this were true, we would have expected its overall success to have been even greater.

Only 2 companies out of 13 have actually been started: Rac [expansion unknown] in Tessenderlo and Canberra in Geel. The rest are still waiting to be admitted. Has this project been only a flash in the pan?



A Industrial Zones
B Watercourses
C Motorways
D Main Roads

Advantages

The philosophy behind the T-zones is to attract new investments. Belgium has advantages of location and productivity to offer, which have to be converted into concrete employment and new markets.

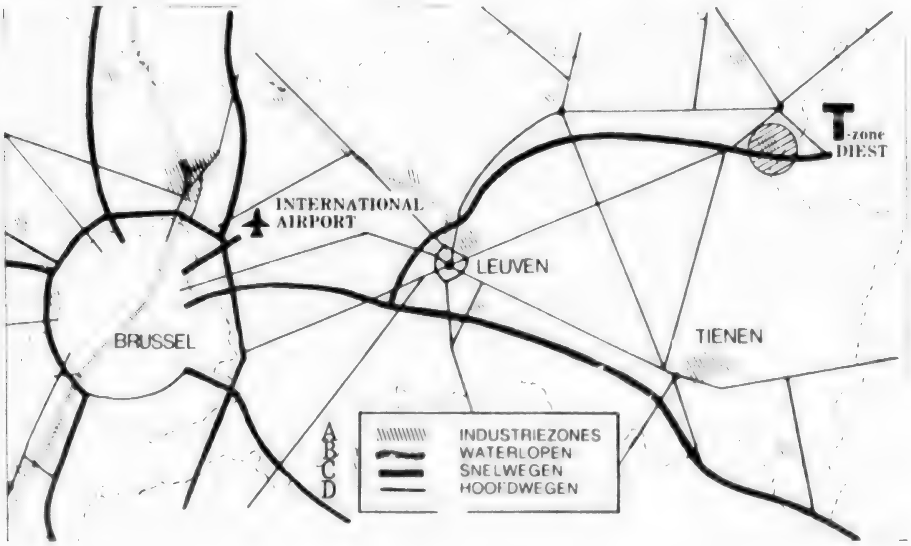
These advantages should automatically favor the economic market. The main obstacle for foreign and Belgian companies has been other factors such as the very unfavorable fiscal and parafiscal system. In this respect, T-zones were to provide a solution.

In a sense our authorities were correct in looking for products of the future. "Silicon Valley" served as an example. But our situation cannot be compared to that of California. In the last few years, the entrepreneurial circumstances in California have improved remarkably due to appropriate financing which made SMC's spring up like mushrooms and caused a considerable increase in employment.

Probably the poor conditions outside the T-zones played an important role in the failure of this initiative. Apparently the advantages of the T-zones do not constitute enough of an incentive to potential entrepreneurs. These advantages are:
- Profits paid on shares or participation certificates and profits retained by the company are excluded from corporate taxes over a 10 year period.

- No registration fees have to be paid on new capital investment or on capital increases without new capital investment.
- Exemption from advance fees on such transferables as profits and several other kinds of financial returns.
- Exemption from advance fees on real estate and materials.
- Exemption from social contributions for foreign employees.

At first glance, T-zones offer some important advantages. But in practice we see that other elements of the T-zone concept do not meet the initial expectations.



A Industrial Zones
B Water Courses
C Motorways
D Main Roads

What Was the Intention?

Proponents of the "free market" thought that the T-zone concept would reveal what was going wrong with this country. Its success would demonstrate that lower taxes and less red tape would attract investments, which would result in more employment and economic growth.

Initially it was designed to be a small-scale initiative. But the theorists hoped that other companies would be so envious of T-zone firms that they too would seek the advantages. In other words, enough pressure was to be put upon the authorities to insure that they would either expand the T-zones geographically, or phase out [the government's] regulating and fiscal powers.

But politicians would cease being politicians if they were to concede to such a proposal. The results of this attitude are to be found in the T-zone concept. Furthermore, the conditions for admission have been so strictly

defined that it is absolutely impossible for an average firm to apply.

Super Technology

It is hard to claim that the present T-zones are designed to create a large number of new jobs. The companies interested in T-zones have to manufacture products that are, so to speak, still being invented!

The companies whose applications are now under consideration are active in the following fields: information processing, software, microelectronics, office automation, robotics, telecommunications and bioengineering. The product has to be completely new to avoid domestic competition between companies located inside and outside the T-zones.

This argument, however, makes us wonder if the system is still worthwhile.

The Illusion of Employment

The companies have to employ at least 10 and no more than 200 people. The reason for this is to give SMC's a better chance.

Thus, what is the motive if it is not employment? Probably it is the attraction of new technologies. This is a very interesting starting point, yet the question remains: To what extent do we benefit from all this? When a new product has been developed in a T-zone, it is almost certain that the company concerned will take it abroad for mass production, i.e., to countries with better fiscal and entrepreneurial conditions.

The question is whether our Belgian companies can take advantage of this initiative. After all, new technologies can be purchased just as well abroad. And the T-zone concept is not such that it can enter into competition with similar zones abroad.

Thus the T-zones seem to be nothing more than a prestige project.

Rigidities

Problems arise with the rigid formalities. The application has to be submitted to IWONL [Institute for Scientific Research in Industry and Agriculture], which by definition decides on the innovative nature of the applicant firm. After -- in principle -- 15 days, it advises the board of directors of the T-zone involved, which decides whether the company really meets the specific requirements. When accepted and consequently approved by the competent ministers, the decision is published in the STAATSBLAD. In theory, the period between application and definitive approval lasts 3 months, because each intermediate body is given time to act.

Naturally, the question is: Who decides? As it concerns very specific technologies, it is understandable that few candidates are proposing

identical products. But suppose that two similar companies submit similar applications. In this case, it is not unlikely that the politicized boards would come to discriminatory decisions.

Not Very Interesting

In reality, however, we see that the existence of a T-zone has only a limited influence on the decision to invest. The T-zone is not a magnet but rather a windfall.

The reasoning is very simple: the T-zones are only profitable when there is sufficient capital, know-how and favorable market expectations. Thus the basic economic demands have to be met. If this is done, then the T-zones are only an additional benefit.

So it would be an illusion to believe that there would be no new investments without T-zones.

Everybody Their Own T-Zone?

Many variants of our T-zones are also to be found abroad. Fortunately for these countries they created full-fledged zones that can indeed be called successful.

Take Corby for instance. In the Corby Enterprise Zone in the heart of England 250 new companies have been set up. They provided 5,500 new jobs and 500 million pounds of new investments. And all this in less than 4 years!

The Corby T-zone covers 120 hectares, yet only a small part of the zone is still available. There are both large and small companies and there are no product restrictions. The most important incentives include the lowering of corporate taxes and the exemption from both local and land taxes. The T-zone is supervised by local people coming from the public sector, private industry and the trade unions. Enthusiasm is high because they cooperate in the area's economic development.

After close analysis of Corby, we may conclude that it is very important for each party to understand that classic economic legislation and high taxation are obstacles to economic growth. Thus, an objective approach to the problem has helped build understanding and create a dynamic climate. Government is still participating, but the same public financial help is provided to companies both inside and outside the T-zones.

Impossible in Belgium?

The Belgian authorities should learn from an example like Corby. When T-zones are exclusively for a few high-tech companies and when the decisions are inspired by political motives, we can forget all about the T-zone concept.

A few politicians however are raising the concept of T-zones again. But it remains to be seen whether they will be able to depoliticize the philosophy. If no urgent measures are taken, we will soon be lagging behind other countries.

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CSO: 3698/1025

SPANISH MINISTRY BARS REEXPORT OF DUAL-USE TECHNOLOGY

LD071532 Madrid Domestic Service in Spanish 1200 GMT 7 Jun 85

[Text] Beginning today, Spanish importers who import dual-use technology will not be allowed to reexport it. The official STATE GAZETTE has published an order from the Finance Ministry which regulates these exports. Mercedes Desojo reports:

As of today, an international import certificate, issued by the Finance Ministry, will be needed to purchase civil and military dual-use technology. The certificate will state that these products cannot be reexported without the permission of the Finance Ministry, even if they have been worked on or transformed in Spain. In the event of there being difficulties in controlling this high technology after its importation, the Finance Ministry reserves the right to refuse an international export certificate.

With these regulations our country has acceded to the demands of those Western countries which are developed in high technology, and which belong to the Coordinating Committee for Multilateral Export Controls [COCOM], an international body which controls the reexport of high technology to countries which are considered to be dubious as regards its use: That is, the members of COCOM, the United States in particular, fear that their technological development could be sold to the Eastern bloc countries.

The reexport ban mainly affects electronic components for computers, integrated circuits and strategic raw materials, as well as resistant ceramics. Our country has been subjected to strong international pressure, especially from the United States, to join COCOM. This option is very much linked to our continued membership of NATO. For this reason, Spain has preferred to seek a solution similar to that adopted by other European countries, such as Austria.

The introduction of these regulations will mean the disappearance of all the problems the U.S. authorities placed in the way of the installation of ATT in our country, after the agreement it reached with Telfonic at the beginning of the year. Several Spanish companies are on COCOM's blacklist -- they are accused of having reexported their high technology imports to dubious countries. There are eight such companies, seven of which have not been given any date for their removal from the list, and one which will be removed on 31 May next year.

CSO: 3698/492

TECHNOLOGY TRANSFER

ISAR VALLEY: GREENHOUSE CLIMATE FOR FRG ELECTRONICS INDUSTRY

Duesseldorf HANDELSBLATT in German 15 May p B2

[Article by Wilhelm Wimmer, chief executive secretary of the Chamber of Industry and Commerce for Munich and Upper Bavaria: "Isar Valley has Meaning in the Electronics World"]

[Text] What to an American tourist visiting Munich might be considered as the mere translation of Isartal, the charming countryside by the river around the Bavarian capital, has an entirely different sound to a person interested in electronics: For him the "Isar Valley" that has developed in recent years constitutes an important part of "Silicon Bavaria," which no longer needs to be ashamed next to its name model, the famous Californian "Silicon Valley."

The climate of the Isar Valley, too, already receives the greenhouse effect indispensable for technological innovations from an ideal combination of research and development on the one hand with a sufficiently big--people refer to a critical mass similar to the nuclear technology--agglomeration of firms on the other hand, which are involved in the production and use of microchips and of the software necessary for the operation.

The exceptional importance of the force field of this agglomeration is demonstrated for example by the fact that, of the purely electronics firms located in the Isar Valley, four-fifths have Siemens and at least one-third have MBB as their big customers. Despite all competition, large-scale give and take spurs on to constantly new achievements like in an incubator. This applies not only to the exchange of ideas but also to the experts who find an excellent labor market and in addition an environment with high recreational value.

List of Prominent Names Is Very Long

Electronics is not by any means a domain of the big firms, as had been feared; on the contrary: Especially here smaller and medium-sized enterprises have an excellent chance if they offer original ideas and solutions to problems. The development costs for a new product still remain within limits in this field.

Focal point for the development of the Isar Valley was nonetheless first Siemens AG, whose activities have increasingly shifted from electrical equipment to electronics. Today Siemens is not only a big purchaser of chips but

also the biggest German manufacturer of semiconductors. In this connection it is noteworthy that only a stone's throw away, in Burghausen, the raw material for the chips is being produced; Wacker-Chemitronik has almost 50 percent of the world market share in the production of superpure silicon.

About 220 firms are active in Munich's city railroad area in the core of the electronics field alone (active, passive and optoelectronic components, technology and test equipment, software for computer-assisted production and development processes, raw materials and process materials. It does not seem exaggerated to say that by now, in the farthest reaches of the Isar Valley, all world firms involved in semiconductor technology are present or are represented by subsidiaries.

As examples, names to be mentioned include Texas Instruments (semiconductor production and application in Freising), Motorola (all-around supplier for entertainment and industrial electronics in Unterfoehring), National Semiconductor (full assortment dealer in Fuerstenfeldbruck), Fairchild (among other things, specialist for high-speed circuits and autoelectronics in Garching), Curosil (leading specialist for watch chips in Eching), Intel (microprocessors for personal computers), SGS-Altos (semiconductors in Grafing), Zilog (processors for microcomputers in Taufkirchen), Mostek (semiconductors in Johanneskirchen), Hitachi (components in Landshut, video recorders in Landsberg, European administration in Haar), Digital Equipment, Imnos and Matra Harris.

The latest important Isar Valley flower is Nixdorf; about 1,000 staff members will work in Munich by the end of 1985. In addition, there are important cooperations of firms: Thus in 1984 the European Computer Industry Research Center in Munich started its operations; it is supposed to advance by research projects systematic processing of information for the French firm of Bull, the British ICL, and the German Siemens.

Of the many smaller enterprises, only three are to be picked as examples: Thus M + M in Gruenwald developed an electronic locking system, which first secures the doors correctly; Langwaechner in Unterneukirchen, a microelectronically controlled torque stand; Thermosolar, a vacuum solar collector with electronic control.

In addition, there is the entire software field. Thus 40 percent of all FRG software houses are in Bavaria and most of them again concentrated in and around Munich. Of the multitude of the computer and software suppliers, the following are to be mentioned: Amdahl, Apple, Perkin Elmer, Computervision, Kontron, Microsoft, Digital Research or SM Software.

Aside from the "warmth of the nest" of the agglomeration, especially research and development contribute to the greenhouse climate of the Isar Valley. Outside of the firms' own development laboratories, --thus Siemens spends about DM 800 million for the development of the 4-megabit memory (cooperation with Philips)--especially research facilities at universities, technical colleges and institutes are to be mentioned.

Of the pure R&D institutes, the most renowned is the Fraunhofer Institute for Solid State Technology in Munich-Pasing with its staff of about 100. Main

emphasis is placed on new technologies for the production of sensors, material quality tests and medical electronics and measured data acquisition with microprocessors. For firms, the institute offers services in the design of circuits, a hybrid laboratory for the development of circuits for specific customer needs and advice for new developments and new introduction of microelectronics.

Technical Universities Build Microelectronics Center

Of the numerous chairs at the Munich Technical University on which microelectronics plays a role, there are especially three which deal mainly with this topic, namely the Institute for Integrated Circuits, the Institute for Technical Electronics, and the Institute for Computer-aided Design. The technical universities have specialized mainly in technology transfer and providing advice especially to the medium-size enterprises in the electronics field.

Also to be mentioned is the "Center for Applied Microelectronics of the Bavarian Technical Colleges (ZAM)," which is being built. Here young degree candidates are to receive the opportunity to deal in their work primarily with the problems of the small and medium microelectronics users. Financial support is provided especially by the Free State of Bavaria and the town of Burghausen. "Prime mover" is Wacker-Chemitronic.

Other examples for initiatives by industry, state, the communities are the Sponsorship Circle for New Technologies (FNT), registered association, cofounded by the Chamber of Industry and Commerce for Munich and Upper Bavaria, which is now seeking the required funds for an endowed chair for applied information technology at Munich Technical University and the Munich Technology Center which will offer a first home to innovative new entrepreneurs in an industrial park of the Bavarian capital. The two chambers of industry are shareholders in the sponsoring limited liability company of this technology center.

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